(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 475 601 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
29.10.1997 Bulletin 1997/44

(51) Int Cl.6: G06T 11/60

(21) Application number: 91307565.1

(22) Date of filing: 15.08.1991

(54) A full-colour desktop publishing system

Vollfarbfähiges Desk-Top-Publishing-System

Système en couleur de publication assisté par ordinateur

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: 16.08.1990 AU 1784/90
16.08.1990 AU 1785/90
19.11.1990 AU 3418/90

(43) Date of publication of application:
18.03.1992 Bulletin 1992/12

(73) Proprietors:
- CANON KABUSHIKI KAISHA
Tokyo (JP)
- CANON INFORMATION SYSTEMS RESEARCH AUSTRALIA PTY LTD.
North Ryde, NSW 2113 (AU)

(72) Inventor: Silverbrook, Kia
Woollahra, New South Wales 2025 (AU)

(74) Representative:
Beresford, Keith Denis Lewis et al
BERESFORD & Co.
2-5 Warwick Court
High Holborn
London WC1R 5DJ (GB)

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Printed by Jouve, 75001 PARIS (FR)

Description

The present invention relates to computer graphics and, in particular, discloses a full colour desk top publishing system capable of creating and printing A3 size true colour images at 400 dots per inch (dpi).

DTP systems such as VENTURA PUBLISHER and PAGEMAKER are well known and provide for document and image creation generally in personal computer systems with the aid of a mouse-like input device and a half-tone laser printer (black on white).

However, there exists a need for DTP systems to operate in full colour and to provide greater versatility for image creation and editing. Full colour DTP systems have been constructed but those known arrangements are expensive when high quality is demanded.

US-A-4568983 discloses an image data compression/decompression technique wherein data generated, for example by scanning a document to be duplicated is stored as a number of strips in a memory. Data words defining columns of the scanned strips are encoded by means of Huffman and run length coding. In this technique the whole of the image must be stored in a memory before it can be compressed.

An article entitled 'A parallel architecture for real time video coding' by de Sa et al (ICASSP '90, New Mexico, Vol. 2, 3 March 1990, pages 961-964) discloses a system capable of coding and decoding video signals in real time using several digital signal processors arranged in parallel. Each image is divided into regions which are operated on by respective processors to compress the regions using discrete cosine transform compression techniques. Since this technique uses multiple processors each having their associated memory, there is a considerable hardware burden.

It is an object of the present invention to substantially overcome, or ameliorate some or all of the disadvantages of the prior art.

In accordance with one aspect of the present invention there is provided a method of creating an image wherein the said image is formed as a plurality of bands and said bands are stored as compressed image data, characterised in that the method comprises at least one of the steps of

forming said image by multiple sequential passes over said bands, each said band being compressed and stored during a respective pass; and
editing said image by multiple sequential passes over said bands, each said band being compressed and stored during a respective pass.

In order that the present invention may be more readily understood, an embodiment thereof will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is aschematic block diagram of DTP system incorporating the preferred embodiment;
Fig. 2 is a schematic block diagram of a circuit of a graphics system included in the DTP system of Fig. 1; and
Fig. 3 is a graphical representation of a page image;
Fig. 4 shows a layered graphics image; and
Fig. 5 illustrates the formation of the layers of Fig. 4;
Fig. 6 shows the band rendering of the image of Fig. 4.

Tables 1 to 21 show various preferred application examples utilizing a number of processing steps.

Fig. 1 shows a desktop publishing system (DTP) 100 which has been configured for high performance, high quality and high functionality at low cost. The illustration of Fig. 1 shows the major functional blocks within the system 100 and basic data flow between the various blocks. Control connections are not shown for the sake of clarity but would be understood by those by skilled in the art.

The DTP system 100 essentially comprises a computer system 200 and a graphics system 300 that are interconnected via a system bus 130. The computer system 200 can be any general purpose computer such as a Sun workstation for example.

The DTP system 100 also has a user interface 110 which includes a keyboard 112 which is used primarily for text entry and a digitizer 114 which acts as a pressure sensitive digitising tablet for painting, drawing and command entry. The user interface 110 connects via serial connections 116 to a serial port 205, such as an RS232 arrangement, of the computer system 200. The DTP system 100 also includes a disk drive unit 120 which can include a magneto-optical disk drive (MOD) 122 and a standard hard disk drive (HDD) 124. The HDD 124 can be used for storage of standard colour DTP system data. The disk drive unit 120 interfaces to the computer system 200 via a connection 126 to a port 210 such as a Small Computer Systems Interface (SCSI).

The computer system 200 also has an interface device 215 which allows for a connection 110 to be made to a network bus 105 such as an Ethernet.

The computer system 200 includes a general purpose processor 230 such as a 68040 processor manufactured

by Motorola. The processor 230 includes various software layers which perform various functions within the DTP system 100. An operating system 235 such as the Unix operating system acts as a software layer which provides system utilities such as multi-tasking kernel, file and I/O management and memory management.

A workscreen manager 240 is a software layer provided for communications and screen management functions. For example, the workscreen manager 240 can include an X-Windows system which is responsible for screen display management, including Windows, Icons, Cursors, and Buttons. In the case of "WYSIWYG" images, screen rendering is performed with the system 100 of a render pipeline which takes high level image representations in the form of display lists and converts them to colour pixel data. The workscreen manager 240 can also include the MOTIF system which is a style of user interface useful in DTP applications and in the operation of the DTP system 100.

An applications layer 245 is also provided which implements specific application necessary for desktop publishing. For example, the application layer 245 can include a colour Japanese language DTP system as well as graphics applications useful in the system 100. Other applications include English language document creation applications and filters such as a Postscript Level 2 to a Command Interface filter which converts one applications language into the specific command interface language used in the computer system 200. Preferably, the operating system 235 is multi-tasking such that more than one application can be implemented at any time. The applications layer 245 provides for the preparation of a page description language (PDL) of objects used to form a page image. The PDL is compiled to provide a high level representation of the page image as a display list.

A host render layer 250 forms part of the render pipeline. Whenever a new image is to be rendered (created), the host render layer 250 translates display list information from a display list memory 220 into a render list 397 which forms part of the graphics system 300. The host render layer 250 includes steps such as:

(a) calculation of the exact position, size, colour, blend and other characteristics of each text character;
(b) calculation of a spacial sub-division array to increase the speed of any subsequent rendering processes;
(c) calculation of spline outlines for all object based graphics images;
(d) culling objects and graphics which are not to be rendered, for example because they are on a different page of a multiple page document, or where only a portion of a page is to be rendered; and
(e) routing of ADCT+ compressed files for expansion.

The display list memory 220 includes high level object based descriptions of coloured documents. The data contained in the display list memory 220 contains floating point object definitions, extending ASCII text definitions, and a ADCT+ compressed pixel images. The display list 220 is optimised for flexibility and ease of interactive modification and is a relatively compact description of any particular image. Pages of graphics and text have data sizes generally less than 10 Kbytes. A single display list can define a multiple page document.

The graphics system 300 as seen in Fig. 1, is structured about a compositing bus 305 which is generally 32 bits wide occupying 8 bits for each of red, green, blue and matte (transparencies) (RGBM) data.

The graphics system 300 includes a render processor 310 which is preferably a high performance 32 bit RISC processor such as the Intel I960 CA device with high speed DRAM memory interfaces and on-chip data and instruction caches. The render processor 310 also includes DMA channels for reading and writing ADCT+ compressed data to and from storage areas formed in DRAM. The main function of the render processor 310 is to convert render list data 398 into graphics engine commands 312. This process is known as BAND RENDER, and must be performed for each 8 line block of a page image and forms part of the render pipeline.

The render processor 310 outputs RGBM data 314 to a graphics engine 320 which composites runs, blends, bit maps, and other graphics commands into a composite line store 330. The graphics engine 320 is critical to the high performance of the DTP system 100 as it performs pixel and line level operations in hardware. Generally, the graphics engine 320 performs operations at a rate of 13.5 million pixels per second, even where complex transparency and colour blend operations are to be performed for every pixel. The graphics engine 320 is capable of performing many operations at a rate 100 times faster than is presently available in software implementations. A full description of a specific example of the graphics engine 320 can be found in European Patent Application EP-A-0 465 250.

Also connected to the compositing bus 305 is an ADCT+ processor 340 which converts ADCT+ compressed images into pixel data and vice versa in the manner described in Australian Patent Application No. PK1784 entitled "Compressed Image Stores for High Resolution Computer Graphics" of 16 August 1990, from which priority is claimed, and European Application EP-A-0 473 341.

The ADCT+ processor 340 performs adaptive discrete cosine transforms of pixel data to provide compressed images in a manner described in the CCITT/ISO JPEG standard. The ADCT+ processor includes variations to the JPEG standard which permit improvements in the quality of reconstructed text and allows for the insertion of marker codes at the end of each 8 line block of compressed data. Using the ADCT+ processor 340, a full A3 400 dot per inch page image which would normally occupy 98 MBytes of DRAM, can be stored in approximately 4 MBytes of memory in the destination/source location 390 which generally occupies about 12 MBytes of the DRAM 420.

The graphics system 300 includes a number of designated memory locations which are formed in DRAM. Those memory locations provide storage for Huffman tables 380, compressed image files 385, compressed image data 390 having both destination 391 and source 392 partitions, a buffer 395, the render list 397 and for font data 399. With reference to Fig. 2, each of these designated memory locations is formed within 32 megabytes of DRAM 420.

The render list 397 is a low level object based description of an image to be shown on a workscreen 140 of the system 300. The workscreen 140 can be either a video display or a liquid crystal display. The render list 397 contains data indicative of individual spline definitions, individual character positions, ADCT+ compressed pixel images, and a spacial sub-division system for speed optimisation. The render list 397 is optimised for speed and is generally large in comparison with the display list 220. Approximately 4 MBytes of memory is allocated for the render list 397. In very complex object based images, more than this amount may be required. In such cases the image must be rendered in several passes.

The font data cache 399 is used to store font data in both outline format and pixel format.

The file store 385 contains an image file in ADCT+ compressed form which is typically an image file to be expanded and composited with the existing source image. The file ADCT+ image may contain more than one compressed image file. It is also forms part of the render pipeline.

The source page image store 392 is a section of the DRAM 420. It forms part of the compositing pipeline. For each compositing pass, data in the source page image store 392 is expanded, compressed and written into the destination page image store 391 occupying adjacent memory locations in the DRAM 420. As the image source is no longer required when a new image is created, the source page image store 392 is overwritten by the destination page image.

Similarly, the destination page image store 391 stores the ADCT+ compressed page image after compositing. The destination page image of one compositing pass will typically become the source page image for the next compositing pass. The destination page image store 391 is also part of the compositing pipeline.

The image buffer 395 is a section of the DRAM 420 used to temporarily buffer an 8 line block of the page image so that it can be processed by the render processor 310. The types of processing typically performed include formatting into graphics engine commands, and software anti-aliased zoom operations.

The Huffman tables 380 are a section of the DRAM 420 used to store the set-up data for a JPEG compression/ decompression device 415, seen in Fig. 2, which forms part of the ADCT+ processor 340. Such a device is the C-Cube CL550B image compression processor. Whenever the JPEG device 415 is changed from compression mode to expansion mode, or vice versa, various tables and registers need to be changed. The largest of these is the Huffman table, but quantization tables and general registers must also be changed. In many instances, the mode of the compression processor 415 is changed as many as 1,620 times during the composition of a single A3 page. For this reason, the Huffman tables 380 are provided as a separate block of hardware to assist in the rapid change of the processor mode. This hardware consists of a DMA channel and a logic block 490 seen in Fig. 2 which converts the DMA data stream into direct control signals for the JPEG chip 415.

A display frame store 370 connects to the composite bus 305 for the display of graphics images on the workscreen 140. The display frame store 370 is a frame store preferably comprising 1,280 pixels by 1,024 lines with 32 bits per pixel. There are 8 bits for each of red, green, blue and matte planes. The matte plane is not displayed but is used for compositing operations using the graphics engine 320. The display frame store 370 also includes a separate hardware cursor 375, seen in Fig. 2. The display frame store accordingly outputs RGB data to the workscreen 140.

A pan/zoom controller 350 connects to the compositing bus 305 as well as to the display frame store 370 and is used to display a portion of the full page in a window of the workscreen 140. The pan/zoom control unit 350 is capable of integer zoom ratios, such as 1:1, 2:1, 3:1, 4:1, etc. Zoom ratios required to view an entire A3 page on the workscreen is 6:1. Low zoom ratios are useful for close-up views of a portion of a page. The pan/zoom controller 350 is also capable of enlargement of the image for fine detailed work. Enlargements of up to 1:16 are available, resulting in a single page image pixel being written to a 16 × 16 pixel block of the workscreen 140.

Apart from displaying images on the workscreen 140, the DTP system 100, using a colour laser copier 150, allows for image data to be scanned into the system 100 using a scanner 152 of the copier 150 and printed using a printer 154. The colour laser copier 150 can for example be the Canon Colour Laser Copier CLC500 or CLC300. The scanner 152 is capable of scanning an A3 page at 400 dots per inch resolution. The scanner output is in the form of 8 bits for each of red, green, and blue which are buffered simultaneously onto the compositing bus 305. The printer 154 is driven from the compositing bus 305 via a RGB to MCYK converter 360. The converter 360 converts red, green and blue data to magenta, cyan, yellow and black (MCYK) data which is used for the printing process of the printer 154.

The compositing line store 330 is a high speed static memory array which provides 16 lines of page image storage. The compositing line store 330 has four 8 bit planes for red, green, blue and matte. The compositing line store 330 is used in several ways. Firstly, the line store 330 is used as a compositing memory for the page image. In this case, the graphics engine 320 composites 8 lines of object or image data at a time, and the system 300 advances to the next 8 lines of the page image.

Secondly, it is used as a temporary storage buffer for the expanded data of a compressed image file.

Finally, the line store 330 is used as a reordering line buffer for the ADCT+ processor 340. When the DTP system 100 is printing a page, the page image must be expanded synchronously. The compositing line store 330 is used to re-order 8 lines of image data from the 8 × 8 pixel block into 8 lines. All 16 lines of the compositing line store 330 are required in this instance, as the ADCT+ processor 340 must be able to write pixel blocks at the same time as pixel lines are being sent to the printer 154. A similar situation exists for the scanner 152, except in reverse.

The DTP system 100 includes numerous data types that are transferred throughout. Already discussed, are the RGBM type transferred on the compositing bus 305 and RGB data transferred to the converter 360, from the scanner 152, and to workscreen 140.

Also transferred to the display frame store 370 is a synchronous 24 bit RGB pixel data from the workscreen manager 240 via data links 242 and the system bus 130. Such synchronous data is normally used only by the user interface 110 under the control of workscreen manager 240 (such as X-Windows), and is normally written to or read from the workscreen memory formed as VRAM 371 seen in Fig. 2.

Compressed image data is formed by the ADCT+ PROCESSOR 340, and via the files memory 385 and image memory 390, can be buffered onto the system bus 130. The system bus 130, together with the network bus 105 carry mixed data types and can distribute those data types to peripheral devices connected to the network 105.

Referring now to Fig. 2, a schematic block diagram of the graphics system 300 is shown. The system 300 includes four main busses, one of which is the system bus 130 already described and another of which is the compositing bus 305, also described. A render bus 311 interconnects circuit components associated with image generation and editing. Connected to the render bus 311 is the render processor 310, a boot EPROM 430 which contains low level controlling software, the graphics engine 320 and the ADCT+ processor 340 which includes the JPEG device 415 and the ADCT extension 410. The system DRAM 420 connects via two bus drivers 450 and 451 to the render bus 311 and the system bus 130, respectively. In this manner, data can be buffered into and out of each of the Huffman tables 380, compressed files 385, image storage 390, the buffer 395, the render list 397 and the front data store 399 onto either bus 311 or 130. A logic block 490 is provided for direct memory access (DMA) of the Huffman tables 380 stored in the DRAM 420 to the JPEG chip 415. A bus driver 452 is provided for direct memory access between the compositing memory 330 and the DRAM 420 via the data packer unit 410. At a bus driver 452 also allows direct memory access of the JPEG extension data stored in the DRAM 420 to the JPEG chip 415, via the ADCT extension unit 410.

In a similar manner, the display frame store 370 connects to the compositing bus 305 via a bus driver 454. The bus driver 454 supplies a VRAM 371 which is central to the display frame store 370. The VRAM 371 outputs to RAMDAC's 372 for each of red, green and blue which provide video output to the workscreen 140. The display frame store 370 also includes an oscillator 373 which drives a clock generator 374 for the control of the RAMDAC 372. A separate cursor unit 375 is provided for control of the workscreen 140. A video bus 378 is provided which permits interconnection with the compositing bus 305 and the system bus 130. In this manner, workscreen data from a workscreen manager 240 can be buffered directly onto the video bus via a bus driver 453.

Having now described the general configuration of the desktop publishing system 100, specific operations and sequences can be described in greater detail.

OPERATION OF THE WORKSCREEN

The DTP system 100 supports all of the capabilities of a page imaging system on the workscreen 140. To enable interactive graphics in a window environment, the workscreen 140 also has some other capabilities, including:

- Direct access to any pixel: The G.P. processor 230 (68040) has direct memory mapped access to the workscreen VRAM 371.
- Image generation in any order: Unlike the page image, which must be generated in left-to-right order, the workscreen image can be built in any order.
- Horizontal graphics engine runs: The graphics engine 320 is only capable of vertical runs to the page image. Runs to the workscreen 140 can be either horizontal or vertical.
- Hardware zoom: A hardware zoom facility is included for transferring pixels from the page image to the workscreen 140 at integer zoom ratios. This does not operate on the workscreen alone, so cannot be used for real-time pan or zoom.
- Windowing capability: The DTP system 100 hardware and software environment supports multiple windows, which may overlap.
- Colour palette: The workscreen 140 includes a RAMDAC 372 color palette for each of the red, green and blue components. These palettes provide an arbitrary transfer function between the screen memory and the colour actually displayed on the workscreen 140. These palettes can be loaded with transfer functions designed to match the screen colour and gamma to that of the printer 154. A perfect match is not possible, as the printer 154 and screen 140 have different colour gamuts.

Interactive Graphics

There are several common features of the user interface of the DTP system 100 to known interactive graphics systems. However, some other features of the DTP system 100 differ, such as:

- Object movement: As with most computer systems, the system 100 has no hardware support for interactive movement of pixel images on the screen. Movement of this kind is conventionally achieved by moving a simple representation of the object, such as a bounding box. This can be done by the G.P. processor 230 (68040) by drawing lines of inverted colour by direct pixel access. The image can be restored as the bounding box is moved by re-inverting the old bounding box position.
- Handles: On-screen handles for objects, lines and splines can be drawn in inverted colour in a similar manner to the the bounding boxes.
- Windows: Window borders and filled areas can be drawn rapidly using graphics engine commands 312. As the graphics engine 320 can draw both horizontal and vertical lines to the workscreen 140, rectangles can be drawn very rapidly.
- WYSIWYG windows: Windows containing accurate WYSIWYG representations of the page image can be created by using a render pipeline to generate the screen image, or by generating a page image and "zooming" it to the workscreen. The render pipeline and other pipeline structures are more fully disclosed in European Patent Application EP-A-0 473 341 filed on the even date entitled "Pipeline Structures for High Resolution Computer Graphics" claiming the same priority as the present application.

Workscreen Operation While Compositing

The system 100 hardware supports continued operation while page compositing is in process. This operation can be in two ways:

- Direct pixel access: Access to the workscreen VRAM 371 by the G.P. processor 230 is unaffected during compositing operations.
- Graphics engine operations: Graphics engine 320 runs to the workscreen 140 cannot occur exactly simultaneously with compositing, but can be interleaved between each 8 line band of the page creation process. This means that the average latency to workscreen updates caused by simultaneous compositing operation is around 4mS.

Workscreen Operation While Printing or Scanning

Interactive graphics and object graphics operations to the workscreen can continue while printing or scanning. However, it is not possible to expand or compress an ADCT+ image file while scanning or printing, as the ADCT+ compression processor is fully utilised at these times.

Printing, Scanning and Compositing

The DTP system 100 cannot perform any combination of printing, scanning, or compositing simultaneously. This is because printing and scanning are synchronous operations which both require the compression processor for their full duration.

<RENDERING SOFTWARE TECHNIQUE>

The formation of pixel image data from object based data is known in the art as rendering. As such, rendering opaque images involves writing pixel image data into memory. However, when images are combining of pixel images, generally by controlling the proportion of two or more source images in a destination or composited image. Accordingly, rendering transparent images involves compositing newly rendered objects with existing pixel image data.

Using an ADCT+ compressed image store 390 requires that the image must be calculated in essentially the same order as the printer 154 requires the output data for printing. With the Canon colour laser printing process, printing occurs from the bottom left to the top right of an A3 page in landscape mode, as seen in Fig. 3.

This requirement for scan-line ordered image creation is different from the usual method of creating two dimensional object-based graphic images.

Most known systems, including most Postscript interpreters, use the "painters algorithm" which achieves the effect of obscuring underlying objects simply by "writing over" them in a pixel mapped (or bitmapped for black and white) image store. To create the image shown in Fig. 4, the image is written object by object into the page image store, with

each pixel of a new image replacing the pixel already present, in the manner shown in Fig. 5.

This method has the advantage of simplicity in that the image generation process need only consider each object in turn. This simplicity makes the method relatively easy to optimise for speed. Generally, a complete pixel mapped image store is required. For full colour A3 images at 400 dpi, this results in a memory requirement of approximately 96 MBytes per page.

It is possible to create the same image by creating rectangular strips, or bands. This is known as band rendering and is illustrated in Fig. 6. This is useful for systems which do not possess a full page memory, such as some laser printers and dot matrix printers.

Band rendering has the disadvantage of complexity in that all of the objects must be stored, usually in a display list, and the appropriate section of each object must be created for each band. During the process of creating each band, the painters algorithm can be used to overlay the visible objects in that band. This usually is substantially slower than when an entire page store is available, as each object must be created and clipped to each band.

The ADCT+ image compression system used in the DTP system 100 works on blocks of 8 × 8 pixels. An A4 image with 6,480 lines × 4,632 pixels contains 810 × 579 pixel blocks. The rendering system in the DTP system 100 renders bands of 579 pixel blocks (8 vertical scan lines) in one pass. This rendering process must be repeated for 810 bands to render an entire A3 image.

The requirement to render 810 separate bands for each image places special concerns for speed and efficiency on the image generation process. For example, if an appropriate approach is not taken, image rendering could easily be 100 times slower than with conventional techniques. This problem is solved in the DTP system 100 by a combination of techniques, including the following:

- Conversion of the high level display list 220 into a low level render list 297 optimised for speed. While this process is complex and time consuming, it is only performed once for each image.
- Generation of a spatial subdivision array, so that the render processor 310 automatically "knows" which part of the render list 397 to process for each band.
- Inclusion of vertically scanned bitmapped font data 399 and a high speed format for outline font data.
- Inclusion of a very high speed rendering processor 310.
- Inclusion of special hardware - the graphics engine 320 - to speed up colour, bitmap, transparency, and area fill operations by several orders of magnitude.
- Inclusion of high speed image compositing hardware.

The combination of these techniques makes the DTP system 100 operate at very high speed. A3 size images can be created in as little as 6 seconds, and will typically take less than 20 seconds. This means that the DTP system 100 image generation speed is comparable to the Colour Copier print speed under most circumstances.

The order of image creation for the page image is limited by the nature of the image compression method and the image raster format required by the colour laser copier 150. For the Canon CLC500, image creation order must be from left to right of an A3 page in landscape format, or an A4 page in portrait format. Horizontal compositing runs to the 8 line buffer for the page image would be limited to eight pixels long, so only vertical runs are supported. There is no access to individual pixels of the page image without expanding and compressing the entire page.

However, the screen image has no such limitations. The image can be built in any order, and runs can be either vertical or horizontal. Individual pixels can also be addressed in random order. This makes the generation of interactive user interfaces substantially easier.

PROCESSING STEPS

Various processing steps that act on data in the DTP system 100 can now be described. As indicated above, the image is processed in bands generally 8 lines wide. Because of this, the composite line store 330 is preferably a multiple of 8 lines. Most preferably it is formed having a 24 line capacity including source, composite and destination locations. The band processing of data allows for individual processing steps to be pipelined which improves image generation speed.

BFI - Buffer File Image

This configuration provides for buffering of an expanded file image into the buffer 395 in DRAM, where it can be processed by the render processor 310. This step is performed where there is no matte associated with the file image. Where a matte is included, the step "Buffer file image and matte" is used.

Eight lines of RGB pixel data from the expanded image file are copied from the composite line store 330 into the DRAM buffer 395. This copying is performed by block DMA transfers initiated by the render processor 310.

This step will be performed once for every 8 line block of the image file. Buffering of the image data is required in most circumstances because the image data will typically be much larger than the command FIFO (seen in Fig. 2) of the Graphics Engine 320, and the composite line store 330 cannot be read at the same time as compositing.

As to the preconditions for the BFI process, eight lines of a file image must be expanded into the composite line store 330, and a DMA controller in the render processor 310 seen in Fig. 2 must be set up to transfer data from the compositing line store 330 to the DRAM buffer 395.

BIM - Buffer File Image and Matte

This configuration provides for the buffering of an expanded file image and file matte into the DRAM buffer 395, where it can be processed by the render processor. This data is in RGBM format, and can be transferred directly as RGBM pixels to the graphics engine 320.

Eight lines of RGBM pixel data from the expanded image file are copied from the composite line store 330, into the DRAM buffer 395. This copying is performed by block DMA transfers of the render processor 310.

As to preconditions, eight lines of a file image must be expanded into the composite line store 330, eight lines of a file matte must be expanded into the composite line store 330, and the DMA controller in the render processor 310 must be set up to transfer data from the compositing line store 330 to the DRAM buffer 395.

CBM - Compositing Using Both Mattes

This configuration provides for the compositing of RGB image data with the composite line buffer 330 using the combination of an image matte and object transparency or a file matte.

RGB and matte pixel data is read from the compositing line buffer 330, composited with data generated by the graphics engine 320, and written back to the compositing line buffer 330 at the same address.

The RGB data generated by the graphics engine 320 can be in the form of object based data expanded into Colour Runs or Colour Blends, or RGB pixel data derived from File images which are transferred the graphics engine 320.

The compositing is controlled by the combination of matte data in the compositing line store 330 and transparency data generated by the graphics engine 330. This transparency data can be in the form of object based data expanded into Transparency Runs or Transparency Blends, Bitmap data, or Matte pixel data derived from File images which are transferred the graphics engine 320.

Regarding preconditions, graphic engine commands 312 must be established in the graphics engine 320.

- 8 lines of the page image must exist in the compositing line store 330, and
- 8 lines of the page matte must exist in the compositing line store 330.

CCB - Clear Compositing Buffer

This configuration provides for the clearing of the compositing line buffer 330 prior to the generation of images.

The compositing line buffer 330 has the capability of being cleared as the composited image is compressed. Therefore, it is only necessary to explicitly clear the compositing line buffer 330 for the first 8 line block of the image.

Eight runs of opaque white, of length equal to 4,632 pixels, are written to the compositing line buffer 330 by the graphics engine 320. The only precondition is that the graphics engine 312 commands must be established in the graphics engine 320.

CDL - Create Display List

The creation of a Display list is usually the first step in the creation of an image. A Display list is composed of data describing the image, and may contain graphic objects, text, and ADCT+ compressed images. The DTP 100 rendering system accepts display lists in the form defined by the command interface software layer (SCI).

A display list 220 may be derived from several sources:

1) It may be created interactively using the application 245 or other applications.
2) It may be created automatically by an application package, such as a graphing application.
3) It may be converted from some other form of display list or page description language, such as Postscript.
4) It may be retrieved from disk 120 as a previously created file.
5) It may be received over the network 105 from a remote workstation which is using the DTP system 100 as a printing resource.

CFF - Compositing File Using File Matte

This configuration provides for the compositing of RGB image data with the composite line buffer 330.

This step is performed where there is no matte associated with the page image. Where a Page matte is included, the step "Compositing using page matte" is used.

RGB pixel data is read from the compositing line store 330, composited with data generated by the graphics engine 320, and written back to the compositing line store 330 at the same address. The RGB data generated by the graphics engine 320 is in the form of RGB pixel data derived from File images which are transferred to the graphics engine 20. The compositing is controlled by Matte pixel data derived from a File matte which are transferred to the graphics engine 320.

As to preconditions, graphic engine commands 312 must be established in the graphics engine 320, and 8 lines of the page image must exist in the compositing line store 330.

CFI - Compress File Image

This configuration provides for the process of compressing a File image after scanning. When an image is initially scanned, it will typically be an entire A3 image. This is used to trim a scanned image for saving as a File image.

Only the selected rectangular region of the original scanned image is compressed. This region must be aligned with the 8 × 8 pixel grid of the scanned image. Eight lines of the RGB pixel data in the Compositing line buffer 330 are compressed by the ADCT+ system 340 in compression mode. This data is written to the destination compressed page image 391 in DRAM 420. The data required by the ADCT+ system 340 is in 8 × 8 pixel blocks, but is stored in the compositing line store 330 in Raster format. Therefore, the address sequence used when reading from the line buffer reorders the data.

Three preconditions must be met. Firstly, the ADCT+ processor 340 must be set up into compression mode, the DMA controller 425 must be set up to transfer data from the ADCT+ system 340 to the destination compressed page image 391 in DRAM 420, and the compositing line store 330,address generator must be set up with the appropriate start pixels and line length for the destination image size and position.

CFM - Compress File Matte

This configuration provides for the process of compressing a file matte after compositing. This step also clears the matte plane of compositing buffer 330 to transparent to prepare for object graphics in the next 8 line block.

Eight lines of the composited matte pixel data in the Compositing line buffer 330 are compressed by the ADCT+ system 340 in compression mode. This data is written to the destination compressed file matte 391 in DRAM 420. The data required by the ADCT+ system 340 is in 8 × 8 pixel blocks, but is stored in the compositing line buffer 330 in Raster format. Therefore, the address sequence used when reading from the line buffer re-orders the data.

For preconditions, the ADCT+ processor 340 must be set up into compression mode, the DMA controller in the render processor 310 must be set up to transfer data from the ADCT+ system 340 to the destination compressed file matte 391 in DRAM 420.

The compositing line store 330 address generator must be set up in the appropriate re-ordering mode.

CFO - Compositing File using Object Matte

This configuration provides for the compositing of RGB image data with the Composite line buffer 330.

RGB pixel data is read from the compositing line buffer 330, composited with data generated by the graphics engine 320, and written back to the compositing line buffer 330 at the same address.

The RGB data generated by the graphics engine 320 is in the form of RGB pixel data derived from File images which are transferred to the graphics engine 320.

The compositing is controlled by transparency data generated by the graphics engine 320, which is in the form of object based data expanded into Transparency Runs or Transparency Blends or Bitmap data.

Preconditions: Graphicengine commands 312 must be established in the graphics engine 320 and 8 lines of the page image must exist in the compositing line store 330.

CFP - Compositing File using Page Matte

This configuration provides for the compositing of RGB image data with the composite line buffer 330 using a matte associated with the page image.

RGB and matte pixel data is read from the compositing line store 30, composited with data generated by the

graphics engine 320, and written back to the compositing line store 330 at the same address.

The RGB data generated by the graphics engine 320 is in the form of RGB pixel data derived from file images which are transferred to the graphics engine 320.

Regarding preconditions, graphic engine commands 312 must be established in the graphics engine 320, 8 lines of the page image must exist in the compositing line store 330 and 8 lines of the page matte must exist in the compositing line store 330.

CMO - Composite Matte Only

It is possible to generate complex object based mattes by using drawing tools with the colour component suppressed. In this way, a matte can be "painted" using multiple layers of transparency. When using such a matte to composite files, the matte can be generated in much the same manner as for object graphics, by suppressing the RGB colour components during compositing.

Matte pixel data is read from the compositing line store 330, composited with data generated by the graphics engine 320, and written back to the compositing line store 330 at the same address.

The matte (transparency) generated by the graphics engine 320 is in the form of object based data expanded into Transparency Runs or Transparency Blends or Bitmap data. Either the page matte of the file matte may be composited using this method.

Preconditions: Graphic engine commands 312 must be established in the graphics engine 321 and 8 lines of the page matte or file matte must exist in the compositing line store 330.

COI - Composite Object Based Image

This configuration provides for the compositing of object based graphics (and text) with the composite line buffer 330.

RGB pixel data is read from the compositing line buffer 330, composited with data generated by the graphics engine 320, and written back to the compositing line buffer 330 at the same address. The RGB data generated by the graphics engine 320 is in the form of object based data expanded into Colour runs or Colour blends.

The compositing is controlled by transparency data generated by the graphics engine 320, which is in the form of object based data expanded into Transparency Runs or Transparency Blends or Bitmap data.

Preconditions: Graphic engine commands 312 must be established in the graphics engine 320 and 8 lines of the page image must exist in the compositing line buffer 330, except where the compositing memory is completely filled with opaque runs (for example, when using the White Run command to generate a blank background).

CPI - Compress Page Image

This configuration provides for the process of compressing a Page image after compositing. This step also clears the compositing buffer 30 to white to prepare for object graphics in the next 8 line block.

Eight lines of the composited RGB pixel data in the Compositing line buffer 330 are compressed by the ADCT+ system 340 in compression mode. This data is written to the destination compressed page image 391 n DRAM 420. The data required by the ADCT+ system 340 is in 8 × 8 pixel blocks, but it is stored in the compositing line buffer 330 in Raster format. Therefore, the address sequence used when reading from the line buffer reorders the data.

For preconditions the ADCT+ processor 340 must be set up into compression mode, the DMA controller in the render processor 310 must be et up to transfer data from the ADCT+ system 340 to the destination compressed page image 391 in DRAM 420, and the compositing line buffer address generator 410 must be set up in the appropriate re-ordering mode.

CPM - Compress Page Matte

This configuration provides for the process of compressing a page Matte after compositing. This step also clears the matte plane of compositing buffer 330 to transparent to prepare for object graphics in the next 8 line block.

Eight lines of the composited matte pixel data in the Compositing line buffer 330 are compressed by the ADCT+ system 340 in compression mode. This data is written to the destination compressed page matte 391 n DRAM 420. The data required by the ADCT+ system is in 8 × 8 pixel blocks, but is stored in the compositing line buffer 330 in Raster format. Therefore, the address sequence used when reading from the line buffer reorders the data.

Preconditions: The ADCT+ processor 340 must be set up into compression mode, the DMA controller in the render processor 310 must be set up to transfer data from the ADCT+ system 340 to the destination compressed page matte 391 in DRAM 420 and the compositing line buffer 330 address generator 410 must be set up in the appropriate re-

ordering mode.

CRL - Create Render List

This data path is used to convert a display list 220 in the form defined by the command interface (SCI) layer into a render list 397.

The conversion from a display list 220 to a render list 397 is performed by the Host Render program running on the G.P. processor 230. The display list 220 is read from memory on the computer system 200, converted, and stored as a render list in the shared memory (DRAM 420). ADCT+ image files which form part of the display list 220 are transferred to the shared memory (420) without alteration. While these are part of the render list 397, they are shown separately as their data path diverges from that of object graphics after this stage.

Preconditions: A display list 220 in command interface layer format is required for conversion.

CTW - Composite to Workscreen

This configuration provides for the compositing of object based graphics (and text) with the workscreen 140. This configuration is used to provide high speed interactive WYSIWYG graphics.

RGB pixel data is read directly from the display frame store 370, composited with data generated by the graphics engine 320, and written back to the display frame store 370 at the same address. Note that memory access to the workscreen 140 is substantially slower than to the compositing line buffer 330, so the compositing pixel rate will be much lower. However, the workscreen 140 contains only 4.37% as many pixels as the page image, so the image creation rate should be acceptable.

Preconditions: Graphics engine commands 312 must be established in the graphics engine 320.

CWM - Composite using Workscreen Matte

This configuration provides for compositing of object based graphics (and text) with the workscreen 140, using the workscreen matte plane. This configuration is used to provide high speed interactive WYSIWYG graphics.

RBG and matte pixel data is read directly from the display frame store 370, composited with data generated by the graphics engine 320, and written back to the display frame store 370 at the same address. In most circumstances, the workscreen matte plane is not altered by this process. However, the DTP system 100 has the capability of simulating the cumulative interaction between paint and a textured background. When this capability is utilised, the matte plane is also altered during compositing. Note that memory access to the workscreen 140 is substantially slower than to the Compositing line buffer 330, so the compositing pixel rate will be much lower. However, the workscreen contains only 4.37% as many pixels as the page image, so the image creation rate should be acceptable.

Preconditions: Graphics engine commands 312 must be established in the graphics engine 330.

DXP - Draw X-Windows Pixels

This configuration provides for the drawing of graphics to the workscreen 140 by writing individual pixels via direct access to the workscreen VRAM 371. This method is relative slow, but allows pixels to be written in any order, and access to the workscreen memory 371 by this method is available at all times.

RGB pixel data is written directly to the workscreen memory 371, by the G.P. processor 320.

EFI - Expand File Image

This configuration provides for the process of expanding a compressed image file ready for compositing with the source image.

Eight lines of the ADCT+ compressed image file 385 are expanded into RGB pixel data by the ADCT+ system 340 in expansion mode. This data s written directly to the composite line buffer 330. The data from the ADCT+ system 340 is in 8 X 8 pixel blocks, but is stored in the composite line buffer 330 in Raster format. Therefore, the address sequence used when writing to the line buffer re-orders the data. This step will be performed once for every 8 line block of the image file.

The preconditions are that the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the file image 385 in DRAM 420 to the ADCT+ expander 340, and the composite line buffer 330 address generator 410 must be set up in the appropriate reordering mode.

EFM - Expand File Matte

This configuration provides for the process of expanding a File matte before compositing. The File matte can be used to control compositing of Files with the page image.

Eight lines of the ADCT+ compressed file matte are expanded from the source 392 into Matte pixel data by the ADCT+ system 340 in expansion mode. This data is written directly to the matte plane of the composite line buffer 330. The RGB planes of the composite line buffer are not affected. The data from the ADCT+ system 340 is in 8 X 8 pixel blocks, but is stored in the composite line buffer 330 in Raster format. Therefore, the address sequence used when writing to the line buffer re-orders the data.

As to preconditions, the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the file matte 392 in DRAM 420 to the ADCT+ expander340, and the compositing line buffer 340 address generator 410 must be set up in the appropriate reordering mode.

EPI - Expand Page Image

This configuration provides for the process of expanding a Page image ready for compositing. This is generally the first step in the process of compositing new information with an existing page image.

Eight lines of the ADCT+ compressed Page image are expanded from the source 392 into RGB pixel data by the ADCT+ system 340 in expansion mode. This data is written directly to the composite line buffer 330. The data from the ADCT+ system 340 is in 8 X 8 pixel blocks, but is stored in the compositing memory in Raster format. Therefore, the address sequence used when writing to the line buffer re-orders the data.

The preconditions are that the ADCT+ processor 340 must be set up into expansion mode, and the DMA controller in the render processor 310 must be set up to transfer data from the source image 392 in DRAM 420 to the ADCT+ expander, and the compositing line buffer 330 address generator 10 must be set up in the appropriate re-ordering mode.

EPM - Expand Page Matte

This configuration provides for the process of expanding a Page matte before compositing. The page matte can be used to control compositing of files and object graphics with the page image.

Eight lines of the ADCT+ compressed page matte are expanded from the source 293 into matte pixel data by the ADCT+ system 340 in expansion mode. This data is written directly to the Matte plane of the composite line buffer 330. The RGB planes of the composite line buffer 330 are not affected. The data from the ADCT+ system 340 is in 8 X 8 pixel blocks, but is stored in the compositing line buffer 330 in Raster format.

Therefore, the address sequence used when writing to the line buffer re-orders the data.

Preconditions are that the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the page matte 392 in DRAM 420 to the ADCT+ expander, and the compositing line buffer 330 address generator 410 must be set up in the appropriate reordering mode.

FAJ - Filter ADCT+ File to JPEG Format

When transferring image files from the DTP system 100 to systems which use the JPEG standard, the image format must be converted from ADCT+ to JPEG formats. Conversion from a ADCT+ file to an JPEG file requires the following processes:

1) The text detect array must be discarded. This will mean that the benefit of text detection will not be available, but there is no way for non ADCT+ systems to reproduce this benefit.
2) There is no need to remove the marker codes, as the presence of marker codes is a special mode of the baseline JPEG standard.

The ADCT+ format file is passed from the display list 220 through a "filter" program in the applications layer 245 which converts the file to JPEG format which then written to the Hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 122 under the control of the operating system 235.

FFI - Format File Image

This configuration provides for the formatting of an expanded and buffered file image 395 from RGB pixels into graphics engine commands 312. This step is performed where there is no matte associated with the file image. Where a matte is included, the step "Format file image and matte" is used.

A graphics engine command 312 header is written to the graphics engine 320, specifying the number of pixels to be composited, the start pixel address, and the compositing mode. Where the graphics engine 312 command includes RGB pixel data, the run of RGB pixel data from the buffered image file is copied by the DRAM buffer 395 into the graphics engine 320. This copying is performed by render processor 310 performing block DMA transfers. This run may be longer than a graphics engine 320 FIFO 321 length (seen in Fig. 2), in which case a FIFO 321 full signal temporarily stalls the DMA transfer. This step is performed once for every compositing run. There are typically eight compositing runs for each 8 line block of an image file.

For preconditions, the RGB image data must be in the DRAM buffer 95, and the DMA controller in the render processor 310 must be set up to transfer data from the DRAM buffer 395 to the Graphics engine FIFO 321.

FIM - Format File Image and Matte

This configuration provides for the formatting of an expanded and buffered file image and file matte from RGBM pixels into graphics engine commands 312.

A graphics engine command 312 header is written to the graphics engine 320, specifying the number of pixels to be composited, the start pixel address, and the compositing mode. The relevant graphics engine commands 312 include RGBM pixel data from the buffered file image pixel data. This data is copied from the DRAM buffer 395 into the graphics engine 320 by the render processor 310 performing block DMA transfers. The data run may be longer than the graphics engine FIFO 321 length, in which case the FIFO full signal temporarily stalls the DMA transfer. This step is performed once for every compositing run. There are typically eight compositing runs for each 8 line block of an image file.

The preconditions are that the RGBM image data must be in the DRAM buffer 395, and the DMA controller 425 must be set up to transfer data from the DRAM buffer 395 to the graphics engine FIFO 321.

FJA - Filter JPEG File to ADCT+ Format

When transferring image files from systems which use the JPEG standard to the DTP system 100, the image format must be converted from JPEG to ADCT+ formats. Conversion from a JPEG file to an ADCT+ file requires the following processes:

1) A text detect array must be cleared, to indicate that each cell is to be treated as if it were an image cell and not a text cell. This maintains full JPEG image quality, although it does not take advantage of the ADCT+ text improvements.

2) Marker codes are inserted into the JPEG data stream, at the end of each 8 line block. This requires that the JPEG data steam be interpreted to establish where the blocks are, and reconstructed with marker codes installed. The DCPM encoded DC values within each block must be adapted, as the presence of the marker code will reset the DCPM register at the beginning of the 8 line block.

The JPEG format file is read from the Hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 122 under the control of the operating system 235 and passed through a "filter" program in the applications layer 245 which converts the file to ADCT+ format for storage in the display lists 220.

FWI - Fast Write of File Image

This configuration provides for the fast expansion and writing of a file image directly to the compositing line store 330.

This operates substantially faster than the more flexible compositing of a file, as the file data does not need to be buffered in DRAM 420, formatted into graphics engine commands 312, or composited. However, this can only be done where there is no matte or object based transparency associated with the file (therefore the image will be rectangular), and where the file can be aligned to the 8 × 8 pixel blocks used by the ADCT+ compression. This situation is common in most DTP applications.

Eight lines of the ADCT+ compressed image file 385 are expanded into RGB pixel data by the ADCT+ system 340 in expansion mode. This data is written directly to the compositing line buffer 330. This will overwrite the existing contents of the compositing line buffer 330 in the rectangular region specified.

The preconditions are that the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the file image 385 in DRAM 420 to the ADCT+ expander 340, and the compositing line buffer 330 address generator must be set up in the appropriate reordering mode.

LHC - Load Huffman Table for Compress

This data path is used to set up the JPEG Chip 415 into compress mode. This must be done whenever a compression is to be performed when the chip is currently in expand mode.

The compress Huffman tables 380 and the other setup data for the JPEG chip 415 are transferred from DRAM 420 to the JPEG chip 415 by a DMA controller on the render processor 310. This data is in a special format which includes control data, and is written to a hardware location containing circuitry which interprets this data as control signals for the JPEG chip 415. This is so that the entire set-up of the various registers and arrays in the chip 415 can be achieved very rapidly.

The JPEG chip 415 must be changed from expand mode to compress mode (and back again) 810 times to composite a full A3 sized image.

Set-up data for the JPEG chip 415 is loaded into DRAM at boot time.

LHE - Load Huffman Table for Expand

This data path is used to set up the JPEG chip 415 into expand mode. This must be done whenever an expansion is to be performed when the chip 415 is currently in compress mode.

The expand Huffman tables 380 and other setup data for the JPEG chip 415 are transferred from DRAM 420 to the chip 415 a DMA controller on the render processor 410. This data is in a special format which includes control data, and is written to a hardware location containing circuitry which interprets this data as control signals for the JPEG chip 415. This is so that the entire set-up of the various registers and arrays in the chip 415 can be achieved very rapidly.

The chip 415 must be changed from compress mode to expand mode (and back again) 810 times to composite a full A3 sized image.

Set-up data for the JPEG chip 415 is loaded into DRAM at boot time.

PRN - Print

This configuration shows the process of printing an image. The compressed page image is expanded into RGB pixel data in real time, converted to MCYK data, and printed one colour component at a time.

The ADCT+ compressed page image 392 is expanded into RGB pixel data in real time by the ADCT+ system 340 in expansion mode. This data is written directly to the compositing line store 330, which is used as a reordering line store to convert the 8 × 8 pixel cells generated by the ADCT processor into raster data. The data is then converted in the converter 360 from RGB into Magenta, Cyan, Yellow, and Black, and printed. The colour laser printer 154 requires synchronous data which cannot be stopped in mid process. Therefore, the print operation must be treated as a single indivisible operation, and must operate in real time. The expansion, conversion and printing process is performed four times for each copy to be printed: once for each of the Magenta, Cyan, Yellow, and Black colour printing passes. Data output timing is controlled by line and page sync signals from the printer 154.

The preconditions are that the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the DRAM 420 to the ADCT+ expander 340 and an RS232C print command is given to the printer 154.

OSZ - Quick Software Zoom

This configuration provides a zoom function performed by software in the render processor 310. This duplicates the function of the hardware pan-zoom engine 350 when displaying an image to the workscreen 140. The zoom is not anti-aliased.

This process is necessary where the file image is to be composited the workscreen 140 at other than unity zoom ratio. The hardware zoom can only be used where the image is to be simply written to the workscreen instead of composited.

The graphics engine 320 reads 8 lines of the RGB and matte pixel data from the buffer image 395 and creates a zoomed version of this for the workscreen by discarding a portion of the pixels. This zoomed version is written back to the image buffer 395. This version can then be transferred to the graphics engine 320 using DMA transfers.

The only precondition is that the RGBM image data must be in the buffer 395 of the DRAM 420.

RAD - Read ADCT+ File From Disk

Display lists 220 may include ADCT+ image files. The display list 20 must directly contain the ADCT+ filename, size, x/y size, matte configuration, and other characteristics, but need not contain the actual ADCT+ data, which can

be as large as 4 MBytes. As the host render process 250 does not directly alter or use the ADCT+ data, this can be transferred directly to the memory (DRAM 420) from disk 120 as and when required. This avoids the double transfers necessary if the data is saved in a display list 220 on the computer system 200, and can therefore improve performance and reduce memory requirements. This is particularly significant for multiple page documents with many file images, where object data and text tends to be very compact. On- demand direct loading of ADCT+ data means that very long colour documents can be edited and printed without running out of memory.

The ADCT+ file is read from the Hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 120 under the control of the operating system 235 and written directly to the DRAM 420 by SCSI DMA transfers from the port 210.

The only precondition is that sufficient space must be available in the DRAM 420. This requires communications between the memory management running on the render processor 310 and the operating system 235.

RAF - Re-Size ADCT+ File

This configuration provides for the re-sizing of an ADCT+ image, performed by software on the render processor 310. This resizing is performed when the image required on the page is a different size than the image stored in the file.

To maintain image quality, aliasing noise is virtually eliminated by performing a bi-linear sample rate conversion. This process is processor intensive, typically involving a minimum of two multiplications and several additions per colour component per pixel. These must be performed in software.

The render processor 310 reads 8 lines of the RGB and matte pixel data from the buffer image 395 and creates a resized version of this for the workscreen 140 using bi-linear sample rate conversion. This resized version is written back to the image buffer 395. The resized image can .hen be transferred to the graphics engine 320 using DMA transfers. The only precondition is that the RGBM image data must be in the RAM buffer.

RBM - Render a Band of Object Matte

This data path is used to convert the object descriptions in a render list 397 into graphics engine "Transparency" commands 312.

The conversion from a render list 397 to Graphics engine commands is performed by a program running on the render processor 310 called BAND RENDER which performs band rendering in the manner already described. The render list 397 is read from shared memory 420 converted, and stored as commands in the Graphics engine command FIFO 321.

One "band" of 8 lines wide is rendered at a time. 810 bands must be rendered for a full A3 sized image, and 405 bands are required for an A4 image.

The only precondition is that a render list containing the object matte must be established.

RBO - Render a Band of Objects

This data path is used to convert the object descriptions in a render list 397 into graphics engine commands 312.

The conversion from a render list 397 to graphics engine commands 312 is performed by a program running on the render processor 310 called BAND RENDER. The render list 397 is read from shared memory 420, converted, and stored as commands in the Graphics engine command FIFO 321.

One "band" of 8 lines wide is rendered at a time. 810 bands must be rendered for a full A3 sized image, and 405 bands are required for an A4 image.

The preconditions for this process are that a render list 397 in appropriate format is required for rendering, all font descriptions required by text in the render list 397 must be available, either in the font cache 399, or by requesting the computer system 200, and the graphics engine command FIFO 321 must not be full. Block synchronisation with the FIFO 321 is required.

RDD - Read Display List from Disk

Display lists 320 are read from disk 120 as a named file by an application, and as spooled information for printing. A display list is composed of data describing the image, and may contain graphic objects, text, and ADCT+ compressed images.

The display list 220 is read from the Hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 122 under the control of the operating system 235 and written to DRAM (not illustrated) in the computer system 200.

RDE - Receive Display List from Ethernet

Normally Display lists are received from the Network 105 (Ethernet) as a remote printing job from another workstation on the network 105. This differs from reading a Display List from disk in that the task will normally be initiated remotely, and can coincide with display list manipulation occurring locally under the control of the application. This function is facilitated by allowing multiple Display lists to exist at the same time.

The Display list is received from Ethernet 105 under the control of the operating system 235 and written to DRAM (not illustrated) on the computer system 200.

RMF - Render Matte with File Image

This configuration shows formatting of an expanded and buffered File Image from RGB pixels into graphics engine commands 312, at the same time as rendering an object based matte.

The conversion from a render list 397 to graphics engine commands 312 is performed by a program running on the render processor 310 called BAND RENDER.

A graphics engine command 312 of a type containing a Transparency Run or Transparency Blend followed by pixel data is written to the graphics engine 320. This is followed by the RGB pixel data from the buffered file image 395. This data is copied from the DRAM buffer 320 into the graphics engine 320 by the render processor 310 performing block DMA transfers.

The preconditions are that a Render list 397 containing the object matte must be established, the RGB image data must be in the DRAM buffer 395 and the DMA controller in the render processor 310 must be set up to transfer data from the DRAM buffer 420 to the graphics engine FIFO 312.

SCN - Scan

This configuration shows scanning an image and compressing the file in ADCT+ format. Using the scanner 152, only a complete A3 page can be scanned using this method. A Trim Scan operation can be used to create smaller files (see the applications section following). The scanned image is not shown on the workscreen 140. This can be achieved using the Scan to workscreen operation.

The scanner 152 data is written directly to the compositing line store 330. In this case, the compositing memory is used as a re-ordering line store to convert the raster data from the scanner 152 to the 8 × 8 pixel cells required by the ADCT+ processor 340. While the scanner data is written to one half of the re-ordering line store, it is read from the other half by the ADCT+ processor 340 and compressed to create the destination image 391. The data from the scanner 152 is synchronous, so the scan operation must be treated as a single indivisible operation, and must operate in real time.

The preconditions are that the ADCT+ processor 340 must be set up into compression mode, the DMA controller in the render processor 310 must be set up to transfer data from the ADCT+ compressor 340 to the DRAM 420, and an RS232C scan command is given to the scanner 152.

STW - Scan to Workscreen

This configuration provides for the scanning of an image and displaying a reduced version on the workscreen 140. This is used to accurately position the image on the scanner 152 and ensure that the zoom ratios, image angle, and other factors are correct before performing the final scan of the image.

The Scanner data is written to the compositing line store 330. In this case, the compositing line store 330 is used as an image buffer to allow a synchronous operation of the scanning and transfer to the workscreen 140. While the scanner data is written to one half of the image buffer, it is read from the other half by the graphics engine 320, which provides the pan-zoom 350 controller with start addresses and zoom ratios. A selection of the pixels from the scanned image are written to the workscreen 140 under the control of the pan-zoom controller 350. The scan operation must be treated as a single operation, and must operate in real time.

Two preconditions exist and are that graphics engine commands 312 are established to set up the pan-zoom controller 350 with the start address of every run. These commands should take into account the zoom ratio of the image, the size and position of the image window, and the presence of any windows which may overlay the image window, and an RS232C scan command is given to the scanner 152.

WAD - Write ADCT+ Image to Disk

ADCT+ images are usually saved to disk as a "File Image" after scanning and trimming.

Complete composited pages can also be saved to disk as ADCT+ images rather than as object based Display lists, but this is unlikely to be a normal operating procedure. The advantage of doing this is to avoid re-compositing a complex image if the same image is to be printed later. ADCT+ images may be stored in the DRAM 420 and directly transferred to disk 120. This avoids the double transfers necessary if the data is saved in a Display list on the computer system 200, and can therefore improve performance and reduce memory requirements.

The ADCT+ file is read from the DRAM 420 under the control of the operating system 235 and written directly to the Hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 122 by SCSI DMA transfers instituted by the port 210.

WDD - Write Display List to Disk

Display lists are saved to disk 120 in two major situations:

1) When saving work created by an Application 245, and
2) When spooling display lists for printing.

This occurs when a display list is received from remote workstations via the network 105, and there is insufficient memory to store the display list in RAM.

A Display list is composed of data describing the image, and may contain graphic objects, text, and ADCT+ compressed images.

The display list 220 resides in DRAM (not illustrated) on the computer system 200. It is written to the hard Disk (HDD) 124 or Magneto-Optical Disk (MOD) 122 under the control of the operating system 235

XRO - X-windows Renders Objects

In order to achieve high performance when creating screen displays for X-Windows operating as the workscreen manager 240, the graphics engine 320 can be used. When drawing to the workscreen 140, the graphics engine 320 can draw either horizontal or vertical (but not diagonal) runs. Therefore filled shapes and aligned lines can be drawn very rapidly, but diagonal lines are slow. There are several ways that X-Windows can draw to the screen, including:

1) Direct drawing of pixels to the VRAM.
2) Creation of a Display list 220, which is converted to a Render list 397 by Host Render 250, and to graphics engine commands 312 by Band Render,
3) Direct creation of a Render list 397, which is converted to graphics engine commands 312 by Band Render,
4) Direct creation of graphics engine commands 312, which are loaded to the graphics engine 320 by the render processor 310, and
5) Direct creation and loading of graphics engine commands 312, (requiring synchronisation locks with the i960 processor).

X-Windows, running on the G.P. processor 230, directly creates graphics engine commands 310 for the Workscreen 140, and passes them to the render processor 310, which places them in the graphics engine command FIFO 321.

ZTW - Zoom to Workscreen

This configuration provides the process of expanding a Page image to display a portion of it on the Workscreen 140.

The ADCT+ compressed page image 392 is expanded into RGB pixel data by the ADCT+ system 340 in expansion mode. This data is written directly to the compositing line store 330. The compositing line store 330 is used as a re-ordering line store to convert the 8 X 8 pixel cells generated by the ADCT+ processor 340 into raster data required by the Pan-Zoom engine 350. The graphics engine 320 reads lines of pixels from the compositing line store 330 and writes them to the pan-zoom engine 350.

The preconditions are that the ADCT+ processor 340 must be set up into expansion mode, the DMA controller in the render processor 310 must be set up to transfer data from the Source Image 392 in DRAM 420 to the ADCT+ expander 340, the compositing line store 330 address generator 410 must be set up in the appropriate re-ordering mode, and graphics engine commands 312 are established to set up the pan-zoom controller 350 with the start address of every run. These commands should take into account the zoom ratio of the image, the size and position of the image window, and the presence of any windows which may overlay the image window.

<APPLICATION EXAMPLES>

Following are examples of how the DTP system 100 hardware can be used to achieve various functions.

These examples show functional possibilities only, and do not imply that the function described will be supported by the Seraph application software, or that the Seraph application will use the particular example shown here in cases where there is more than one way of achieving a function.

The following is not a definitive set of possible functions, but is intended to show enough combinations to convey the capabilities and limitations of the Seraph hardware.

The three letter Mnemonics used in the tables referred to in this section are defined in the preceding section on "processing steps".

The tables are arranged to show those processing steps that are performed simultaneously and sequentially. The application sequence at the top of each table and proceeds down the page (with line). Horizontally aligned processing steps are performed simultaneously.

Example 1 - Composite Layers of Objects with Image

Table 1 shows the steps necessary when compositing graphic objects or text over an existing ADCT+ image. This process is normally be done as part of an interactive image composition sequence. The number of layers of graphic objects that can be composited in one pass is limited only be available render list memory. Typically, many thousands of objects are generally composited in one pass. In subsequent compositing diagram, all contiguous layers of object graphics are shown as a single layer.

Table 1 Notes

1) The rendering of object based images can overlap all of the previous stages until the graphics engine commands 312 for those objects are required for compositing.

2) Loading of the JPEG Chip 415 Huffman tables and other data for compression can begin as soon as the page image has been expanded.

Example 2 - Composite File using Image Matte

Table 2 shows the steps necessary when compositing an ADCT+ compressed file image with the existing ADCT+ page image. This configuration uses an ADCT+ compressed Matte associated with the file to control the compositing of the file image with the page image. This process would normally be done as part of an interactive image composition sequence. A file matte will usually be used to "cut out" the region of interest in a photograph.

Table 2 Notes

1) Loading of the JPEG chip 415 Huffman tables and other data for compression can begin as soon as the page image has been expanded, however, there may be DMA memory contention which will reduce the efficiency of buffering and formatting. For this reason loading of the Huffman tables is shown to occur during compositing.

Example 3 - Composite File using Page Matte

Table 3 shows the steps necessary when compositing an ADCT+ compressed file image with the existing ADCT+ page image. This configuration uses an ADCT+ compressed Matte associated with the page image to control the compositing of the file image with the page image. This process is normally be done as part of an interactive image composition sequence. A page matte is usually used to "protect" some region of the page image from being composited over.

Table 3 Notes

1) Loading of the JPEG chip 415 Huffman tables and other data for compression can begin as soon as the page image has been expanded, however, there may be DMA memory contention which will reduce the efficiency of buffering and formatting. For this reason loading of the tables is shown to occur during compositing.

Example 4 - Composite File using Both Mattes

Table 4 shows the steps necessary when compositing an ADCT+ compressed file image with the existing ADCT+ page image. This configuration uses the simultaneously combination of two mattes to control the compositing of the file image with the page image. These mattes are a matte associated with the page image (the Page Matte) and the matte associated with the file image (the File Matte). This can be used for various special effects, such as to "insert" a file image behind some portions of the page image and in front of other portions, to control the density of an image

based on a page "texture" as well as to allow the placement of images with transparent regions into a "window" (which may be irregular and of variable density) on the page.

Table 4 Notes

1) Compositing with both mattes is a complex operation where the two mattes may be combined in various ways. The functional specification of the graphics engine 320 described in European Patent Application No. EP-A-0 465 250 can be of assistance.

Example 5 - Print Object Graphics and Text Only

Table 5 shows the steps necessary when compositing and printing object based images or text, on a blank page. The number of layers of graphic objects that can be composited in one pass is limited only be available render list memory. Typically, many thousands of objects could be composited in one pass. In subsequent printing diagrams, all contiguous layers of object graphics are shown as a single layer. The background is white. If other colour backgrounds are required, they must be created by overlaying the background with full page graphic objects.

Table 5 Notes

1) The rendering of object based images can overlap all of the previous stages until the graphics engine commands 312 for those objects are required for compositing.
2) Loading of the JPEG chip 415 Huffman tables for compression can be done once, before compositing begins. This is because there are no files to be expanded.
3) The compression operation clears the composite line buffer 330 to white for the next 8 line block.
4) The JPEG chip 415 needs to be loaded with the expansion tables before printing.

Example 6 - Print the Existing Page Image

Table 6 shows the printing of an existing page image, which will typically be in the Source ADCT+ image memory 392.

Example 7 - Print Image, Matte, and Graphics

Table 7 shows the steps necessary when compositing and printing an ADCT+ image file with associated ADCT+ Matte, as well as object based images or text, on a blank page. The background is white. If other colour backgrounds are required, they must be created by overlaying the background with full page graphic objects.

Table 7 Notes

1) The rendering of object based images can overlap all of the previous stages until the graphics engine commands 312 for those objects are required for compositing.
2) Loading of the Huffman tables and other data for compression (expansion) can begin as soon as the last file has been expanded (compressed). Here it is shown to occur after the file data has been formatted and loaded into the graphics engine, to avoid consuming DRAM bandwidth, which may slow down the buffering process.
3) The formatting and compositing of file RGB or RGBM pixel data will usually overlap, as this data will often be larger than the graphics engine command FIFO 321.

Example 8 - Print 2 Images with Object Mattes, and Text

Table 8 shows the steps necessary when compositing and printing two ADCT+ image files, each with object based Mattes, on a blank page. The top layer of the image contains Object based text or graphics. This compositing sequence is only required in regions where the two ADCT+ images share vertical compositing blocks. Where there is no vertical overlap, the compositing may proceed as if there were only one image. The background is white. If other colour backgrounds are required, they must be created by overlaying the background with full page graphic objects.

Table 8 Notes

1) Rendering is of the matte for File 1. This must be completed before File 1 is composited.
2) Rendering is of the matte for File 2. This must be completed before File 2 is composited.
3) Rendering of the top layer of objects and text can begin at any time, but graphics engine commands 312 for the objects cannot be put into the graphics engine 320 until all of the commands for the file compositing are entered (unless there is guaranteed to be no overlap).

Example 9 - Print 2 Images with File Mattes, and Text

Table 9 shows the steps necessary when compositing and printing two ADCT+ Image files, each with associated ADCT+ Mattes, as well as object based text, on a blank page. This compositing sequence is only required in regions where the two ADCT+ images share vertical compositing blocks. Where there is no vertical overlap, the compositing may proceed as if there were only one image. The background is white. If other colour backgrounds are required, they must be created by overlaying the background with full page graphic objects.

Table 9 Notes

1) The rendering of object based text can overlap all of the previous stages until the graphics engine commands 312 for the text are required for compositing.

Example 10 - Print 3 Opaque Rectangular Images and Text

Table 10 shows fast creation of a page with three images and text. This fast compositing method can only be used where there is no matte associated with the image, where there is no page matte, and where the image is aligned to the 8 × 8 ADCT+ pixel grid. Alignment to the grid created a maximum positioning error of +4 pixels, or +0.25 mm. In many circumstances, this position constraint is irrelevant. Alignment to the grid also preserves image quality, as the image will not alter when expanded and re-compressed if the image is grid-aligned. When there is no matte associated with the image, the image will be fully opaque, and rectangular.

Table 10 Notes

1) The rendering of object based text can overlap all of the previous stages until the graphics engine commands 312 for the text are required for compositing.
2) The fast compositing of file images using only the single overwrite step can only be done if the image is opaque, rectangular, and grid aligned.
3) Loading of the Huffman tables and other data for compression can begin as soon as the last file has been expanded.

Example 11 - Zoom to Workscreen

Table 11 shows the steps necessary when displaying a portion of the page image on the workscreen 140 without modifying it. This is used when panning or zooming to display a different portion of the page image than that currently displayed.

Table 11 Notes

1) If the ADCT+ system is already in expansion mode, this step can be omitted.

Example 12 - Composite Graphics to Workscreen

Table 12 shows the steps necessary when directly compositing WYSIWYG object graphics to the workscreen 140. This process would normally be done as part of an interactive image composition sequence, building a display list which can later be rendered to the page image. The number of layers of graphic objects that can be composited in one pass is limited only by available render list memory 397. Compositing to the workscreen 140 has fewer constraints than compositing to the page image, as both horizontal and vertical runs are available, and compositing can proceed in any scan-line order, as long as the viewing order of the objects is maintained.

Table 12 Notes

1) The rendering of object based images can overlap all of the previous stages until the graphics engine commands 312 for those objects are required for compositing.
2) Compositing to the workscreen 140 is not limited to eitht-line blocks. Compositing can also occur either horizontally or vertically. Compositing can occur in any order, as long as the viewing order of objects is maintained (using painter's algorithm).

Example 13 - Composite File to Screen using File Matte

Table 13 shows the steps necessary when directly compositing ADCT+ files to the workscreen 140 using a file matte. This process would normally be done as part of an interactive image composition sequence, building a display list which can later be rendered to the page image. Note that this general method is necessary when compositing to the workscreen 140 using a matte, but the faster method of directly writing the image to the workscreen 140 using the

pan-zoom engine 350 can be used where the image is rectangular and there is no matte involved.
Table 13 Notes

1) The JPEG chip 415 needs to be set up in expansion mode only once, as no compression is used.
2) A software zoom is required, as the Pan-zoom engine 350 cannot be used for compositing. In this case, a quick non-antialiased zoom is used.

Example 14 - Writing Files to Workscreen Without Matte

Table 14 shows the steps necessary when directly writing an ADCT+ file to the workscreen 140 where the image is rectangular and there is no ADCT+ matte or object matte involved. This is the fastest method, as the Pan-zoom engine 350 is used. This process would normally be done as part of an interactive image composition sequence, building a display list which can later be rendered to the page image.
Table 14 Notes

1) As only one file is being written to the screen, the render pipeline may not always be used, and the process may occur under the direct command of other software.
2) The JPEG chip 415 needs to be set up in expansion mode only once, as no compression is used.
3) The Pan-zoom controller 350 must be set up so that the destination addresses are those of the region of the screen that the image is to appear. The Pan-zoom controller 350 also performs a clipping function.

Example 15 - Composite File to Screen using Object Matte

Table 15 shows the steps necessary when directly compositing ADCT+ files to the workscreen using an object based matte. This process would normally be done as part of an interactive image composition sequence, building a display list which can later be rendered to the page image. Note that this general method is necessary when compositing to the workscreen 140 using a matte, but the faster method of directly writing the image to the workscreen 140 using the pan-zoom engine 350 can be used where the image is rectangular and there is no matter involved. This method is suitable when the object matte is simple. For object mattes containing multiple layers of overlapping transparency see the sequence on "compositing with complex object mattes".
Table 15 Notes

1) The JPEG chip 415 needs to be set up in expansion mode only once, as no compression is used.
2) A software zoom is required, as the Pan-zoom engine 350 cannot be used for compositing. In this case, a quick non-antialiased zoom is used.

Example 16 - Test Scan

Table 16 shows the configuration used when the user wishes to see the result of a scan without saving a file to disk 120. This will usually be in order to position the scanned image correctly. This process does not produce a "destination" ADCT+ image.

Example 17 - Scan an A3 Image

Table 17 shows scanning and compressing of an image from the Colour Copier scanner 152. The colour copier 150 only supports one scan mode, which is to scan an entire A3 image. Where smaller images are required, these should be trimmed from the A3 page using the scan and trim sequence.

Example 18 - Scan, Trim and File an Image

The scanned data is always the entire A3 page. However, in most cases the image actually required will be smaller than the complete A3 page, and it is desirable to be able to save just the portion required.

The procedure to achieve this is shown in Table 18 and is to scan and compress the complete image, expand the scanned image, select the region that is desired as the final image, compress this region, and write the compressed image to disk. ADCT+ file sizes must be in increments of 8 × 8 pixel cells. So that no further image degradation occurs when expanding and recompressing the scanner image, the image cells are not moved in the process of trimming an image. Therefore, the ADCT+ file size will be rounded out to the nearest 8 × 8 pixel cell on all four sides of the image. This method can only produce rectangular images. Where it is desirable that the shape of the picture is other than

rectangular, a file matte should be created.
Table 18 Notes

1) The Test Scan is performed as many times as is required by the user to align the image on the scanner and set the scanner controls to the desired values.
2) The file expanded is the scanner file in the Destination image memory 391. As is usually the case, the destination memory 391 is treated as the source memory 392 for expansion. The Source and destination normally share approximately the same memory space 420.
3) The compression line size and start address will usually vary from that used in expansion.

TABLE 1

COMPOSITE LAYERS OF OBJECTS WITH IMAGE

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBO	LHE			LHE	LHE						1	
	RBO	EPI		EPI	EPI	EPI						1	Expand page
	RBO	LHC	COI	COI	LHC	LHC						1,2	Object 1
	RBO		COI	COI								1	Object 2
	RBO		⇨	⇨								1	⇨
			COI	COI									Object n
		CPI		CPI	CPI	CPI							Compress
End of repeated section													

TABLE 2

COMPOSITE FILE USING IMAGE MATTE

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
		LHE			LHE	LHE							
		EPI		EPI	EPI	EPI							Expand page
		EFI		EFI	EFI	EFI							File Image
		EFM		EFM	EFM	EFM							Matte
		BIM		BIM		BIM							
		FIM	FIM			FIM							
		LHC	CFF	CFF	LHC	LHC						1	Composite
		CPI		CPI	CPI	CPI							Compress
End of repeated section													

TABLE 3

COMPOSITE FILE USING PAGE MATTE

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
		LHE			LHE	LHE							
		EPI		EPI	EPI	EPI							Expand page
		EPM		EPM	EPM	EPM							Page matte
		EFI		EFI	EFI	EFI							File Image
		BFI		BFI		BFI							
		FFI	FFI			FFI							
		LHC	CFP	CFP	LHC	LHC						1	Composite
		CPI		CPI	CPI	CPI							Compress
End of repeated section													

TABLE 4

COMPOSITE FILE USING BOTH MATTES

Processing steps / G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
		LHE			LHE	LHE							
		EPI		EPI	EPI	EPI							Expand page
		EPM		EPM	EPM	EPM							Page matte
		EFI		EFI	EFI	EFI							File Image
		EFM		EFM	EFM	EFM							File Matte
		BIM		BIM		BIM							
		FIM	FIM			FIM							
		LHC	CBM	CBM	LHC	LHC						1	Composite
		CPI		CPI	CPI	CPI							Compress
End of repeated section													

TABLE 5

PRINT OBJECT GRAPHICS AND TEXT ONLY

Processing steps	G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
	CDL													Application
	CRL						CRL							Host render
			LHC			LHC	LHC						2	
This section repeated for each 8 line block														
		RBO		CCB	CCB								1	Clear page
		RBO		COI	COI								1	Object 1
		RBO		COI	COI								1	Object 2
		RBO		⇩	⇩								1	⇩
				COI	COI									Object n
			CPI		CPI	CPI	CPI							Compress
End of repeated section														
			LHE			LHE	LHE						3	
			PRN		PRN	PRN	PRN		PRN					Print

TABLE 6

PRINT THE EXISTING PAGE IMAGE

Processing steps	G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
			LHE PRN		PRN	LHE PRN	LHE PRN		PRN					Print

TABLE 7

PRINT IMAGE, MATTE, AND GRAPHICS

Processing steps / G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBO	LHE	CCB	CCB	LHE	LHE						1	Clear page
	RBO	EFI		EFI	EFI	EFI						1	Expand file
	RBO	EFM		EFM	EFM	EFM						1	Exp. matte
	RBO	BIM		BIM		BIM						1	Buffer file
	RBO	FIM	FIM			FIM						1,3	Format file
	RBO	LHC	CFF	CFF	LHC	LHC						1,2,3	File image
			COI	COI									Objects
		CPI		CPI	CPI	CPI							Compress
End of repeated section													
		LHE			LHE	LHE							
		PRN		PRN	PRN	PRN		PRN					Print

TABLE 8

PRINT 2 IMAGES WITH OBJECT MATTES, AND TEXT

G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBM	LHE	CCB	CCB	LHE	LHE						1	Clear page
	RBM	EFI		EFI	EFI	EFI						1	File 1
	RBM	BFI		BFI		BFI						1	File 1
	RMF	RMF	RMF			RMF						1	Matte 1
	RBM		CFO	CFO								2	Composite
	RBM	EFI		EFI	EFI	EFI						2	File 2
	RBM	BFI		BFI		BFI						2	File 2
	RMF	RMF	RMF			RMF						2	Matte 2
	RBO	LHC	CFO	CFO	LHC	LHC						3	Composite
			COI	COI									Text
		CPI		CPI	CPI	CPI							Compress
End of repeated section													
		LHE			LHE	LHE							
		PRN		PRN	PRN	PRN		PRN					Print

TABLE 9

PRINT 2 IMAGES WITH FILE MATTES, AND TEXT

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
	RBO	LHE	CCB	CCB		LHE	LHE					1	
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBO	LHE	CCB	CCB	LHE	LHE						1	Clear page
	RBO	EFI		EFI	EFI	EFI						1	File 1
	RBO	EFM		EFM	EFM	EFM						1	Matte 1
	RBO	BIM		BIM		BIM						1	
	RBO	FIM	FIM			FIM						1	
	RBO		CFM	CFM								1	Comp. 1
	RBO	EFI		EFI	EFI	EFI						1	File 2
	RBO	EFM		EFM	EFM	EFM						1	Matte 2
	RBO	BIM		BIM		BIM						1	
	RBO	FIM	FIM			FIM						1	
	RBO	LHC	CFM	CFM	LHC	LHC						1	Comp. 2
			COI	COI									Text
		CPI		CPI	CPI	CPI							Compress
End of repeated section													
		LHE			LHE	LHE							
		PRN		PRN	PRN	PRN		PRN					Print

TABLE 10

PRINT 3 OPAQUE RECTANGULAR IMAGES AND TEXT

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBO	LHE	CCB	CCB	LHE	LHE						1	Clear page
	RBO	FWI		FWI	FWI	FWI						1,2	File 1
	RBO	FWI		FWI	FWI	FWI						1,2	File 2
	RBO	FWI		FWI	FWI	FWI						1,2	File 3
		LHC	COI	COI	LHC	LHC						3	Text
		CPI		CPI	CPI	CPI							Compress
End of repeated section													
		LHE			LHE	LHE							
		PRN		PRN	PRN	PRN		PRN					Print

TABLE 11

ZOOM TO WORKSCREEN

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
		LHE ZTW		ZTW	LHE ZTW	LHE ZTW				ZTW	ZTW	1	Zoom page

TABLE 12

COMPOSITE GRAPHICS TO WORKSCREEN

Processing steps G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
This section repeated for each 8 line block													
	RBO											1	
	RBO		CTW	CTW								1,2	Object 1
	RBO		CTW	CTW								1,2	Object 2
	RBO		⇩	⇩								1,2	⇩
			CTW	CTW								2	Object n
End of repeated section													

TABLE 13

COMPOSITE FILE TO SCREEN USING FILE MATTE

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL													Application
CRL						CRL							Host render
		LHE			LHE	LHE						1	
This section repeated for each 8 line block													
		EFI		EFI	EFI	EFI							File
		EFM		EFM	EFM	EFM							Matte
		BIM		BIM		BIM							
	QSZ					QSZ						2	Zoom
		FIM	FIM			FIM							
			CTW								CTW		Composite
End of repeated section													

TABLE 14

WRITING FILES TO WORKSCREEN WITHOUT MATTE

Processing steps G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL												1	Application
CRL						CRL						1	Host render
		LHE			LHE	LHE						2	
This section repeated for each 8 line block													
		ZTW		ZTW	ZTW	ZTW				ZTW	ZTW	3	Zoom page
End of repeated section													

TABLE 15

COMPOSITE FILE TO SCREEN USING OBJECT MATTE

Processing steps: G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
CDL CRL		LHE			LHE	CRL LHE						1	Application Host render
This section repeated for each 8 line block													
	QSZ RMF	EFI BFI RMF	RMF CTW	EFI BFI	EFI	EFI BFI QSZ RMF					CTW	2 3	File Zoom Composite
End of repeated section													

TABLE 16

TEST SCAN

Processing steps	G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
			LHC STW		STW	LHC STW	LHC STW	STW						Scan

TABLE 17

SCAN AN A3 IMAGE

G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/ Network 105	Pan-zoom 350	Workscreen 140	Notes	Comments
		LHC SCN		SCN	LHC SCN	LHC SCN	SCN						Scan

TABLE 18

SCAN, TRIM AND FILE AN IMAGE

Processing steps	G.P. processor 230	Render processor 310	Render Processor DMA	Graphics engine 320	Compositing store 330	ADCT+ 340	DRAM 420	Scanner 152	Printer 154	Disk 120/Network 105	Pan-zoom 350	Workstation 140	Notes	Comments
			LHC			LHC	LHC							
			SCN		SCN	SCN	SCN	SCN						Scan
This section repeated for each 8 line block														
			LHE	CCB	CCB	LHE	LHE							Clear page
			EFI		EFI	EFI	EFI						1	Expand
			LHC			LHC	LHC							
			CFI		CFI	CFI	CFI						2	Compress
End of repeated section														
	WAD									WAD				Write file

Claims

1. A method of creating an image wherein the said image is formed as a plurality of bands and said bands are stored as compressed image data, characterised in that the method comprises at least one of the steps of

   forming said image by multiple sequential passes over said bands, each said band being compressed and stored during a respective pass; and
   editing said image by multiple sequential passes over said bands, each said band being compressed and stored during a respective pass.

2. A method as claimed in claim 1, the said method being characterised in that:

   (a) the plurality of bands are formed as follows:

(1) rendering a band of the image from objects in a display list (220);
(2) compressing the band of the image;
(3) storing the compressed band of the image; and
(4) repeating steps (1) to (3) for each band of the image:

(b) editing a selected band of the image by:

(1) expanding the selected band of the stored image:
(2) rendering an additional band of the image from additional objects in said display list;
(3) compositing the additional band with the selected band to form an edited selected band of the image;
(4) compressing the edited selected band of the image;
(5) storing the compressed edited selected band;

(c) repeating steps (b)(1)-(b)(5) for each band of the image; and
(d) repeating steps (b) and (c) as required to create a final edited image.

3. A method as claimed in claim 2, wherein the selected bands are selected consecutively across said image.

4. A method as claimed in claim 2 or 3, wherein said method comprises the further steps of:

(e) expanding bands of the final edited image; and
(f) displaying the expanded bands to reproduce the final edited image.

5. A method as claimed in any one of the preceding claims, wherein adaptive discrete cosine transform methods are used for compressing and expanding bands of the image.

6. A method as claimed in claim 5, wherein said adaptive discrete cosine transform methods are implemented in accordance with ISO/IEC JTC1/SC2/WG8 JPEG technical specifications.

7. A method as claimed in any one of the preceding claims 2 to 6, wherein said rendering and expanding steps produce, and said compositing and compressing steps act upon red (R), green (G), blue (B) and matte (M) pixel image data, said rendering steps being performed by a render processor (310), said compositing steps being performed by a graphics engine (320) and an associated compositing memory (330), said compressing and expanding steps are performed by a compander (415), with said image data being stored in an associated storage means (390,420).

8. A method as claimed in claim 7, wherein said method includes the image processing step of buffering a file image (BFI) in which a band of RGB pixel image data is transferred from said compositing memory to a buffer location (395) in said storage means.

9. A method as claimed in claim 7, wherein the image processing step of buffering a file image and matte (BIM) wherein a band of RGBM pixel image data is transferred from said compositing memory to a buffer location (395) in said storage means.

10. A method as claimed in claim 7, wherein the image processing step of compositing using both mattes (CBM) wherein RGBM pixel image data is read from said compositing memory, composited with RGBM pixel image data generated by said graphics engine and written back into said compositing memory, the compositing operation being controlled by a combination of matte data in said compositing memory and transparency data generated by said graphic engine.

11. A method as claimed in claim 7, wherein the image processing step of clearing the compositing memory (CCB) wherein bands of opaque white pixel image data are generated by said graphics engine and written into said compositing memory.

12. A method as claimed in claim 7, wherein said method includes the image processing step of creating a display list (CDL) in a computing means (200) connected to said render processor means, said display list being composed of data describing the image selected from the group consisting of graphic objects, text, and compressed image data.

13. A method as claimed in claim 7, wherein said method includes the image processing step of compositing a file using a file matte (CFF), wherein RGB pixel data is read from said compositing memory, composited with matte data generated by said graphics engine and written back to said compositing memory.

14. A method as claimed in claim 7, wherein said method includes the image processing step of compressing a file image (CFI) wherein a predetermined number of lines of RGB pixel image data are read from said compositing memory, compressed by said compander and written to a compressed image destination location in said storage means.

15. A method as claim in claim 14, wherein said pixel image data is stored in said compositing memory in raster format and is read by said compander in a square array of pixel blocks.

16. A method as claimed in claim 7, wherein said method includes the image processing step of compressing a file matte (CFM), wherein a predetermined number of lines of matte pixel data are read from said compositing memory and compressed by said compander, the compressed data being stored in a compressed matte destination location in said storage means.

17. A method as claimed in claim 16, wherein said matte pixel data stored in said compositing memory is in raster format and is read by said compander as a square array of pixel blocks.

18. A method as claimed in claim 7, wherein said method includes the image processing step of compositing a file using an object matte (CFO), wherein RGB pixel image data is read from said compositing memory, composited with RGB pixel data generated by said graphics engine, and written back into said compositing memory at corresponding addresses.

19. A method as claimed in claim 18, wherein said compositing is controlled by transparency data generated by said graphics engine, said transparency data being in the form of object based data expanded into data selected from the group consisting of transparency runs, transparency blends, and bit map data.

20. A method as claimed in claim 7, wherein said method includes the image processing step of compositing a file using page matte (CFP) wherein RGBM pixel image data is read from said compositing memory, composited with data generated by said graphics engine, and written back into said compositing memory.

21. A method as claimed in claim 20, wherein said RGB data generated by said graphics engine is in the form of RGB pixel data derived from file image data transferred to said graphics engine, said composing being controlled by matte data in said compositing memory.

22. A method as claimed in claim 7, wherein said method includes the image processing step of compositing a matte only (CMO) wherein matte pixel data is read from said compositing memory, composited with matte data generated by said graphics engine, and written back into said compositing memory.

23. A method as claimed in claim 7, wherein said method includes the image processing step of compositing an object based image (COI), wherein RGB pixel image data is read from said compositing memory, composited with RGB data generated by said graphics engine, and written back into said compositing memory.

24. A method as claimed in claim 23, wherein said RGB data generated by said graphics engine is in the form of object based data expanded into colour runs or colour blends, said compositing being controlled by transparency data generated by said graphics engine in the form of object based data.

25. A method as claimed in claim 7, wherein said method includes the image processing step of compressing a page image (CPI), wherein a predetermined number of lines of RGB pixel image data in said compositing memory are compressed by said compander, the compressed data being stored in a compressed page image destination location in said storage means.

26. A method as claimed in claim 25, wherein said processing step is performed 810 times when compositing an A3 page image, and 405 times when compositing an A4 page image.

27. A method as claimed in claim 7, wherein said method includes the image processing step of compressing a page

matte (CPM), wherein a predetermined number of lines of matte pixel data in said compositing memory are compressed by said compander, wherein said compressed matte data being stored in a compressed page matte destination location in said storage means.

28. A method as claimed in claim 7, wherein said method includes the image processing step of creating a render list (CRL), wherein said display list is read from a memory store (220) of an associated computing means (200) and stored as a render list in said storage means, said render list being directly readable by said render processor for performing rendering operations.

29. A method as claimed in claim 28, wherein said display list results in the creation of compressed image files.

30. A method as claimed in claim 7, wherein said method includes the image processing step of compositing to a workscreen (CTW), wherein RGB pixel image data is read from a workscreen memory (370) associated with a workscreen display (140), composited with RGB data generated by said graphics engine, and written back to said workscreen memory.

31. A method as claimed in claim 7, wherein said method includes the image processing step of compositing using a workscreen matte (CWM), wherein RGBM pixel data is read directly from a workscreen memory (370) associated with a workscreen display (140), composited with RGBM data generated by said graphics engine and written back to said workscreen memory.

32. A method as claimed in claim 7, wherein said method includes the image processing step of drawing workscreen pixels (DXP), wherein an associated computing means generates pixels directly which are written directly into a workscreen memory associated with a workscreen display.

33. A method as claimed in claim 7, wherein said method includes the image processing step of expanding a file image (EFI), wherein a predetermined number of lines of a compressed file image are expanded from said storage means by said compander into RGB pixel image data, the RGB pixel image data being stored in said compositing memory.

34. A method as claimed in claim 7, wherein said method includes the image processing step of expanding a file matte (EFM), wherein a predetermined number of lines of compressed file matte data are expanded into matte pixel data by said compander, said matte pixel data being written directly to a matte plane of said compositing memory.

35. A method as claimed in claim 7, wherein said method includes the image processing step of expanding a page image (EPI), wherein a predetermined number of lines of compressed page image are expanded from said storage means by said compander into RGB pixel image data, the RGB pixel image data being written directly into said compositing memory.

36. A method as claimed in claim 7, wherein said method includes the image processing step of expanding a page matte (EPM), wherein a predetermined number of lines of compressed page matte data are expanded from said storage means by said compander into matte pixel data, said matte pixel data being written directly to a matte plane and said compositing memory.

37. A method as claimed in claim 7, wherein said compander performs adapted discrete cosine transformation in accordance with JPEG technical specifications.

38. A method as claimed in claim 37, wherein said compander also creates in said compressed image data a text detect array to permit text detection, and marker codes inserted at the end of each band of compressed image data.

39. A method as claimed in claim 38, wherein said method comprises the step of filtering compressed image data to the JPEG format (FAJ), wherein the text detect array is discarded.

40. A method as claimed in claim 38, wherein said method comprises the step of filtering JPEG file data into compressed image data (FJA), wherein said text detect array is cleared so as to indicate that each cell of said array is treated as it were an image cell and not a text cell and inserting marker codes at the end of each band.

41. A method as claimed in claim 7, wherein said method includes the image processing step of formatting a file image (FFI), wherein said render processor creates a header command for said graphics engine, which is written to said

graphics engine specifying a number of pixels to be composited, a start pixel address, and a compositing mode.

42. A method as claimed in claim 41, wherein RGB pixel data is transferred from a buffer location (395) of said storage means into said render processor to provide RGB pixel image data as input for said graphics engine.

43. A method as claimed in claim 7, wherein said method includes the image processing step of formatting a file image and matte (FIM), wherein said render processor creates a header command for said graphics engine, which is written to said graphics engine specifying a number of pixels to be composited, a start pixel address, and a compositing mode.

44. A method as claimed in claim 41, wherein RGBM pixel image data is transferred from a buffer location (395) of said storage means into said render processor to provide RGBM pixel image data as input for said graphics engine.

45. A method as claimed in claim 7, wherein said method includes the image processing step of fast write of a file image (FWI), wherein a predetermined number of lines of compressed file image in said storage are expanded into RGB pixel image data by said compander and written into said compositing memory.

46. A method as claimed in claim 7, wherein said method includes the image processing step of having the processing step of loading Huffman tables for compression (LHC), wherein Huffman tables (380) required for adaptive discrete cosine transformation compression of pixel image data are stored in said storage means and are loaded from said storage means into said compander prior to compression processing.

47. A method as claimed in claim 7, wherein said method includes the image processing step of loading of Huffman tables for expansion (LHE) wherein Huffman tables (380) required for adaptive discrete cosine transformation expansion of compressed image data are stored in said storage means and are transferred from said storage means to said compander prior to expansion processing.

48. A method as claimed in claim 7, wherein said method includes the image processing step of printing (PRN), wherein compressed page image data is expanded from said storage means by said compander and written into said compositing memory as pixel image data, said pixel image data being buffered from said compositing memory to a printer (154) for said page image.

49. A method as claimed in claim 48, wherein said RGB pixel image data is converted into magenta, cyan, yellow and black image data for input to said printer.

50. A method as claimed in claim 7, wherein said method includes the image processing step of a quick software zoom (QSZ), wherein said graphics engine reads a predetermined number of lines of RGBM pixel image data via said render processor from a buffer location of said storage means, said graphics engine creating a zoomed version of said image pixel data for display on an associated workscreen (140).

51. A method as claimed in claim 7, wherein said method includes the image processing step of reading a compressed file from disk (RAD), wherein a compressed image file is stored on a hard disk (120) associated with a computing means (200), said compressed image file being read from said hard disk by said computing means and transferred to a location in said storage means.

52. A method as claimed in claim 7, wherein said method includes the image processing step of resizing a compressed image file (RAF), wherein said render processor reads a predetermined number of lines of RGBM pixel data from a buffer location (395) of said storage means and creates a resized version of said data using a bi-linear sample rate conversion, the resized version being written back into the buffer location.

53. A method as claimed in claim 7, wherein said method includes the image processing step of render a band of object matte (RBM), wherein a render list of graphics commands are provided in said storage means and are read by said render processor, said render processor providing a series of graphics engine commands to said graphics engine for the rendering of matte pixel data.

54. A method as claimed in claim 7, wherein said method includes the image processing step of rendering a band of objects (RBO), wherein a render list (397) residing in said storage means is interpreted by said render processor to provide graphics engine commands to said graphics engine for rendering of a band of objects.

55. A method as claimed in claim 54, characterised in that font descriptions (399) required for text are available in said storage means and also input to said render processor.

56. A method as claimed in claim 7, wherein said method includes the image processing step of reading a display list from disk (RDD), wherein associated computer means (200) includes a disk storage means (120) and said display list (220) is read from said disk storage means into said computer means for transfer to said render processor.

57. A method as claimed in claim 7, wherein said method includes the image processing step of receiving a display list from a network (RDE), wherein an associated computer means (200) is connected to a communication network (105) in which a display list (22) is read from said communication network into said computer means for transfer to said render processor.

58. A method as claimed in claim 7, wherein said method includes the image processing step of rendering a matte with a file image (RMF), wherein said render processor converts a render list (397) residing in said storage means into graphics engine commands that are input to said graphics engine, said graphics engine receiving RGB pixel image data from a buffer location (395) of said storage means via said render processor said graphics engine outputting RGBM pixel data.

59. A method as claimed in claim 7, wherein said method includes the image processing step of scanning (SCN), wherein an image scanner (152) provides RGB pixel image data of a scanned page image which is buffered into said compositing memory, said image pixel data being buffered from said compositing memory into said compander and compressed for storage in said storage means as a compressed page image.

60. A method as claimed in claim 7, wherein said method includes the image processing step of scanning to a work-screen (STW), wherein an image scanner (152) provides RGB pixel image data of a scanned page image which is beuffrend into said compositing memory, said pixel image data being buffered from said compositing memory to a display memory (370) associated with a workscreen (140) for the display of image pixel data.

61. A method as claimed in claim 60, wherein a pan/zoon controller (350) connected between said compositing memory and said display memory allows for augmenting the image for display on the workscreen display.

62. A method as claimed in claim 7, wherein said method includes the image processing step of writing a compressed image to disk (WAD), wherein compressed image data is read from said storage means to an associated computer means (200) and stored in a disk storage means (120) connected to said computing means.

63. A method as claimed in claim 7, wherein said method includes the image processing step of writing a display list to disk (WDD), wherein an associated computing means (200) creates a set of display lists (220) and said display lists are transforred from said computing means to a disk drive storage means (120) connected thereto for storage.

64. A method as claimed in claim 7, wherein said method includes the image processing step of directly rendering objects (XRO), wherein an associated computing means (200) directly creates graphics engine commands which are transferred from said computing means via said render processor to said graphics engine for the rendering of objects.

65. A method as claimed in claim 7, wherein said method includes the image processing step of zooming to a work-screen (ZTW), wherein compressed page image data is expanded from said storage means by said compandor and written as pixel image data into said compositing memory, said pixel image being transferred to said graphics engine for writing said data to a pan/zoom controller (350), said pan/zoom controller augmenting said data prior to transferring said data to a display memory (370) associated with a workscreen display (140).

66. A method as claimed in claim 7, wherein said method includes the image creation process of compositing layers of objects with a compressed image, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list (CRL) from said display list;

repeating the following steps for each band of the image:

(iii)simultaneously rendering a band of objects, and loading Huffman tables for expansion (LHE);
(iv) simultaneously rendering a band of objects (RBO), and expanding a page image (EPI) from said storage means;
(v) rendering a band of a first object, loading Huffman tables for compression (LHC), and compositing the object-based image (COI);
(vi) for each further object of the image to be created rendering a band of the further object and compositing the object-based image; and
(vii)compressing a band of the page image (CPI).

67. A method as claimed in claim 7, wherein said method includes the image creation process of compositing a file using an image matte, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list (CRL) from said display list; repeating the following steps for each band of the image:
(iii)loading Huffman tables for expansion (LHE);
(iv) expanding a band of a page image (EPI);
(v) expanding a band of a file image (EFI);
(vi) expanding a band of a file matte (EFM);
(vii)buffering the band of the file image and the matte (BIM);
(viii)formatting a band of the file image and mate (FIM);
(ix) simultaneously loading Huffman tables for compression (LHC), and compositing the band of the file image using file matte (CFF); and
(x) compressing a band of the file image (CFF).

68. A method as claimed in claim 7, wherein said method includes the image creation process of compositing a file using a page matte, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);

repeating the following steps for each band of the image;

(iii)loading Huffman tables for expansion (LHE);
(iv) expanding a band of a page image (EPI);
(v) expanding a band of a page matte (EPM);
(vi) expanding a band of a file image (EFI);
(vii)buffering the band of the file image (BFI);
(viii)formatting a band of the file image (FFI);
(ix) simultaneously loading Huffman tables for compression (LHC), and compositing the band of the file image with the page matte (CFP); and
(x) compressing a band of the page image (CPI).

69. A method as claimed in claim 7, wherein said method includes the image creation process of compositing a file using both page and file mattes, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list (CRL) from said display list;

repeating the following steps for each band of the image:

(iii)loading Huffman tables for expansion (LHE);
(iv) expanding a band of a page image (EPI);
(v) expanding a band of a page matte (EPM);
(vi) expanding a band of a file image (EFI);
(vii)expanding a band of a file matte (EFM);
(viii)buffering the band of the file image and the file matte (BIM);
(ix) formatting a band of the file image and matte (FIM);
(x) simultaneously loading Huffman tables for compression (LHC), and compositing using both file and image

matte (CBM); and
(xi) compressing a band of the page image (CPI).

70. A method as claimed in claim 7, wherein said method includes the image creation process of printing object graphics and text only, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);
(iii)loading Huffman tables for compression (LHC);

repeating the steps (iv) to (vii) for each band of the image:

(iv) rendering a band of objects (RBO) and clearing the compositing memory (CCB);
(v) simultaneously rendering a band of a first object (RBO), and compositing that band of the page image (COI);
(vi) repeating step (v) for each further object of the page image;
(vii)compressing the band of the page image (CPI); and following the conclusion of step (vii) for the last band:
(viii)loading Huffman tables for expansion (LHE); and
(ix) printing the entire image (PRN).

71. A method as claimed in claim 7, wherein said method includes the image creation process of printing an existing page image, said image creation process comprising the sequential processing steps of:

(i) loading Huffman tables for expansion (LHE); and
(ii) printing the page image (PRN).

72. A method as claimed in claim 7, wherein said method includes the image creation process of printing a compressed image with matte and graphics, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);

repeating steps (iii) to (xi) for each band of the image:

(iii)simultaneously rendering a band of objects (RBO), clearing the compositing memory (CCB), and loading Huffman tables for expansion (LHE);
(iv) simultaneously rendering a band of objects (RBO), and expanding a band of a file image (EFI);
(v) simultaneously rendering a band of objects (RBO), and expanding a band of file matte (EFM);
(vi) simultaneously rendering a band of objects (RBO), and buffering the file image and matte (BIM);
(vii)simultaneously rendering a band of objects (RBO), and formatting the file image and matte (FIM);
(viii)simultaneously rendering a band of objects (RBO), loading Huffman tables for compression (LHC) and compositing the band of the file using the file matte (CFF);
(ix) compositing the band of the object-based image (COI);
(x) compressing the band of the page image (CPI); and

following the conclusion of step (xii) for the last band:

(xi) loading Huffman tables for expansion (LHE); and
(xii)printing the page image (PRN).

73. A method as claimed in claim 7, wherein said method includes the image creation process of printing two images with object mattes and text, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);

repeating steps (iii) to (xiii) for each band of the image:

(iii)simultaneously rendering a band of object matte (RBM), clearing the compositing memory (CCB), and

loading Huffman tables for expansion (LHE);
(iv) simultaneously rendering a band of object matte (RBM), and expanding a band of a first file image;
(v) simultaneously rendering a band of object matte, and buffering the band of the first file image (EFI);
(vi) rendering a band of object-based matte with the band of first file image (RMF);
(vii)simultaneously rendering a band of object-based matte (RBM), and compositing the band of the first file image with the object-based matte (CFO);
(viii)simultaneously rendering a band of object-based matte (RBM), and expanding a band of the second file image (EFI);
(ix) simultaneously rendering a band of object matte (RBM), and buffering the band of the second file image (BFI);
(x) rendering a band of object-based matte for the second file image (RMF);
(xi) simultaneously rendering a band of objects (RBO), loading Huffman tables for compression (LHC), and compositing the band of the second file image with its matte (CFO);
(xii)compositing a band of object-based text image (COI);
(xiii)compressing the band of the page image (CPI);

and following the conclusion of step (xiii) for the last band:

(xiv)loading Huffman tables for expansion (LHE); and
(xv) printing the page image (PRN).

74. A method as claimed in claim 7, wherein said method includes the image creation process of printing two images with file mattes and text, said image creation process comprising the sequential processing steps of:

(i) simultaneously rendering a band of objects (RBO), loading Huffman tables for expansion (LHE), and clearing the compositing memory (CCB):
(ii) creating a display list (CDL);
(iii)creating a render list from the display list (CRL);

repeating steps (iv) to (xvi) for each band of the image;

(iv) simultaneously rendering a band of objects (RBO), clearing the compositing memory (CCB), and loading Huffman tables for expansion (LHE);
(v) simultaneously rendering a band of objects (RBO), and expanding a band of a first file image (EFI);
(vi) simultaneously rendering a band of objects (RBO), and expanding a band of a first file matte (EFM);
(vii)simultaneously rendering a band of objects (RBO) and buffering the band of first file image and first file matte (BIM);
(viii)simultaneously rendering a band of objects (RBO), and formatting the band of file image and matte (FIM);
(ix) simultaneously rendering a band of objects (RBO), and compositing the band of first file image using the first file matte (CIM);
(x) simultaneously rendering a band of objects (RBO), and expanding a band of a second file image (EFI);
(xi) simultaneously rendering a band of objects (RBO), and compositing the band of first file image using the first file matte (CFM);
(x) simultaneously rendering a band of objects (RBO), and expanding a band of a second file image (EFI);
(xi) simultaneously rendering a band of objects (RBO), and expanding a band of a second file matte (EFM);
(xii)simultaneously rendering a band of objects (RBO), and buffering the band of the second file image and the band of second file matte (BIM);
(xiii)simultaneously rendering a band of objects (RBO), and formatting the second file image and matte (FIM);
(xiv)simultaneously rendering a band of objects (RBO), loading Huffman tables for compression (LHC), and compositing the band of the second file image and its matte (CFM);
(xv) compositing a band of object-based image text (COI);
(xvi)compressing the band of the page image (CPI); and

following the conclusion of step (xvi) for the last band:

(xvii)loading Huffman tables for expansion (LHE); and
(xviii)printing the page image (PRN).

75. A method as claimed in claim 7, wherein said method includes the image creation process of printing three opaque rectangular images and text, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);

repeating steps (iii) to (viii) for each band of the image:

(iii)simultaneously rendering a band of objects (RBO), clearing the compositing memory (CCB), and loading Huffman tables for expansion (LHE);
(iv) simultaneously rendering a band of objects (RBO), and fast writing a band of a first file image into said compositing memory (FWI);
(v) simultaneously rendering a band of objects (RBO), and fast writing a band of a second file image into said compositing memory (FWI);
(vi) simultaneously rendering a band of objects (RBO), and fast writing a band of a third file image into said compositing memory (FWI);
(vii)simultaneously loading Huffman tables for compression (LHC), and compressing a band of the page image from said compositing memory (COI); and
(viii)compressing the band of the page image (CPI);

following the conclusion of step (viii) for the last band:

(ix) loading Huffman tables for expansion (LHE); and
(x) printing the page image (PRN).

76. A method as claimed in claim 7, wherein said method includes the image creation process of zooming to a workscreen, said image creation process comprising the sequential processing steps of:

(i) loading Huffman tables for expansion (LHE); and
(ii) zooming to a workscreen (ZTW).

77. A method as claimed in claim 7, wherein said method includes the image creation process of compositing graphics to a workscreen, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);

repeating the following steps for each band of the image:

(iii)rendering a band of objects (RBO);
(iv) simultaneously rendering a band of a first object (RBO), and compositing said band to said workscreen (CTW);
(v) repeating step (iv) for each further object of the image;
(vi) compositing the band to the workscreen (CTW).

78. A method as claimed in claim 7, wherein said method includes the image creation process of compositing a file to a workscreen using a file matte, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);
(iii)loading Huffman tables for expansion (LHE);

repeating the following steps for each band of the image:

(iv) expanding a band of the file image (EFI);
(v) expanding a band of the file matte (EFM);
(vi) buffering the band of file image and the band of file matte (BIM);
(vii)performing a quick software zoom on said buffered band (QSZ);

(viii)formatting the band of file image and matte (FIM); and
(ix) compositing the band to the workscreen (CTN).

79. A method as claimed in claim 7, wherein said method includes the image creation process of writing a file image to a workscreen without a matte, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from said display list (CRL);
(iii)loading Huffman tables for expansion (LHE);

repeating the following step for each band of the image:
(iv) zooming the band to the workscreen (ZTW).

80. A method as claimed in claim 7, wherein said method includes the image creation process of compositing a filo image to a workscreen using an object matte, said image creation process comprising the sequential processing steps of:

(i) creating a display list (CDL);
(ii) creating a render list from the display list (CRL);
(iii)loading Huffman tables for expansion (LHE);

repeating the following steps for each band of the image:

(iv) expanding a band of tho file image (EFI);
(v) buffering the band of the file image (BFI);
(vi) performing a quick software zoom on the band of the file image (QSZ);
(vii)rendering a band of matte with the band of file image (RMF); and
(viii)compositing the band to the workscreen (CTW).

81. A method as claimed in claim 7, wherein said method includes the image creation process of performing a test scan, said image creation process comprising the sequential processing steps of:

(i) loading Huffman tables for compression (LHC);
(ii) scanning image data to the workscreen (STW).

82. A method as claimed in claim 7, wherein said method includes the image creation process of scanning a page image, said image creation process comprising the sequential processing steps of:

(i) loading Huffman tables for compression (LHC);
(ii) scanning the page image (SCN).

83. A method as claimed in claim 7, wherein said method includes the image creation process of scanning, trimming and filing a page image, said image creation process comprising the sequential processing steps of:

(i) loading Huffman tables for compression (LHC);
(ii) scanning the page image (SCN);

repeating steps (iii) to (vi) for each band of the image:

(iii)loading Huffman tables for expansion (LHE);
(iv) expanding a band of the file image (EFI);
(v) loading Huffman tables for compression (LHC);
(vi) compressing the band of the file image (CFI);

following the conclusion of step (vi) for the last band:
(vii)writing the compressed data to a non-volatile storage means (WAD).

84. A desk top publishing system for use in the method of creating an image as claimed in any one of the preceding

claims, the system comprising storage means (340) adapted to store compressed image data as a plurality of bands; characterised by means (310,320,330,340) for forming and editing said image using multiple sequential passes over said bands, each said pass being used for one said band to compress and store said band.

Patentansprüche

1. Verfahren zum Erzeugen eines Bilds, wobei das Bild als eine Vielzahl von Bändern erzeugt ist und die Bänder als komprimierte Bilddaten gespeichert sind,
   dadurch gekennzeichnet, daß das Verfahren mindestens einen der Schritte aufweist:

   - Erzeugen des Bilds durch mehrfache, aufeinanderfolgende Durchläufe über die Bänder, wobei jedes Band während eines jeweiligen Durchlaufs komprimiert und gespeichert wird, und
   - Aufbereiten des Bilds durch mehrfache, aufeinanderfolgende Durchläufe über die Bänder, wobei jedes Band während eines jeweiligen Durchlaufs komprimiert und gespeichert wird.

2. Verfahren gemäß Anspruch 1, wobei das Verfahren **dadurch gekennzeichnet ist, daß:**

   (a) die Vielzahl der Bänder wie folgt erzeugt wird:

   (1) Rendern eines Bands des Bilds von Objekten in einer Anzeigeliste (220),
   (2) Komprimieren des Bands des Bilds,
   (3) Speichern des komprimierten Bands des Bilds und
   (4) Wiederholen der Schritte (1) bis (3) für jedes Band des Bilds,

   (b) Aufbereiten eines ausgewählten Bands des Bilds durch:

   (1) Expandieren des ausgewählten Bands des gespeicherten Bilds,
   (2) Rendern eines zusätzlichen Bands des Bilds von zusätzlichen Objekten in der Anzeigeliste,
   (3) Verbinden des zusätzlichen Bands mit dem ausgewählten Band, um ein aufbereitetes, ausgewähltes Band des Bilds zu erzeugen,
   (4) Komprimieren des aufbereiteten, ausgewählten Bands des Bilds,
   (5) Speichern des komprimierten, aufbereiteten, ausgewählten Bands,

   (c) Wiederholen der Schritte (b) (1) - (b) (5) für jedes Band des Bilds und
   (d) Wiederholen der Schritte (b) und (c), wenn erforderlich, um ein endgültig aufbereitetes Bild zu erzeugen.

3. Verfahren gemäß Anspruch 2, wobei die ausgewählten Bänder über das Bild aufeinanderfolgend ausgewählt werden.

4. Verfahren gemäß Anspruch 2 oder 3, wobei das Verfahren ferner die Schritte aufweist:

   (e) Expandieren der Bänder des endgültig aufbereiteten Bilds und
   (f) Anzeigen der expandierten Bänder, um das endgültig aufbereitete Bild wiederzugeben.

5. Verfahren gemäß einem der vorhergehenden Ansprüche, wobei adaptive, diskrete Kosinustransformationsverfahren zum Komprimieren und Expandieren der Bänder des Bilds verwendet werden.

6. Verfahren gemäß Anspruch 5, wobei die adaptiven, diskreten Kosinustransformationsverfahren gemäß den Technischen Spezifikationen ISO/IEC JTC1/SC2/WG8 JPEG implementiert sind.

7. Verfahren gemäß einem der vorhergehenden Ansprüche 2 bis 6, wobei die Render- und Expansionsschritte Rot- (R)-, Grün- (G) -, Blau- (B) - und Transparenz- (M)-Pixelbilddaten erzeugen und die Verbindungs- und Kompressionsschritte auf die Rot- (R)-, Grün- (G)-, Blau- (B) - und Transparenz- (M) - Pixelbilddaten einwirken, wobei die Renderschritte durch einen Renderprozessor (**310**) ausgeführt werden, die Verbindungsschritte durch eine Graphik-Engine (**320**) und einen angeschlossenen Verbundspeicher (**330**) ausgeführt werden, wobei die Kompressions- und Expansionsschritte durch einen Kompander (**415**) ausgeführt werden, wobei die Bilddaten in einer angeschlossenen Speichereinrichtung (**390, 420**) gespeichert werden.

8. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Puffems eines Dateibilds (BFI) aufweist, in welchem ein Band von RGB-Pixelbilddaten aus dem Verbundspeicher in einen Pufferspeicherbereich (395) in der Speichereinrichtung übertragen wird.

9. Verfahren gemäß Anspruch 7, wobei der Bildverarbeitungsschritt des Puffems eines Dateibilds und einer Transparenz-Datei (BIM) ausgeführt wird, wobei ein Band von RGBM-Pixelbilddaten vom Verbundspeicher in einen Pufferspeicherbereich (395) in der Speichereinrichtung übertragen wird.

10. Verfahren gemäß Anspruch 7, wobei der Bildverarbeitungsschritt des Verbindens unter Verwendung beider Transparenz-Dateien (CBM) ausgeführt wird, wobei RGBM-Pixelbilddaten aus dem Verbundspeicher gelesen werden, mit den RGBM-Pixelbilddaten, erzeugt durch die Graphik-Engine, verbunden werden und in den Verbundspeicher zurückgeschrieben werden, wobei die Verbindungsoperation durch einen Kombination von Transparenz-Daten in dem Verbundspeicher und Transparenz-Daten, erzeugt durch die Graphik-Engine, gesteuert wird.

11. Verfahren gemäß Anspruch 7, wobei der Bildverarbeitungsschritt des Löschens des Verbundspeichers (CCB) ausgeführt wird, wobei Bänder von Opakweiß-Pixelbilddaten durch die Graphik-Engine erzeugt und in den Verbundspeicher geschrieben werden.

12. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Erzeugens einer Anzeigeliste (CDL) in einer Computereinrichtung (200) aufweist, welche mit der Renderprozessoreinrichtung verbunden ist, wobei die Anzeigeliste aus Daten zusammengesetzt ist, welche das Bild beschreiben, das aus der graphische Objekte, Text und komprimierte Bilddaten aufweisenden Gruppe ausgewählt ist.

13. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens einer Datei unter Verwendung einer Transparenz-Datei (CFF) aufweist, wobei RGB-Pixeldaten aus dem Verbundspeicher gelesen werden, mit den von der Graphik-Engine erzeugten Transparenz-Daten verbunden werden und in den Verbundspeicher zurückgeschrieben werden.

14. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Komprimierens eines Dateibilds (CFI) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der RGB-Pixelbilddaten aus dem Verbundspeicher gelesen werden, durch den Kompander komprimiert werden und in einen Zielspeicherbereich des komprimierten Bilds in der Speichereinrichtung geschrieben werden.

15. Verfahren gemäß Anspruch 14, wobei die Pixelbilddaten in dem Verbundspeicher im Rasterformat gespeichert werden und durch den Kompander in einer Quadratmatrix der Pixelblöcke gelesen werden.

16. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Komprimierens einer Transparenz-Datei (CFM) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der Transparenz-Pixeldaten aus dem Verbundspeicher gelesen werden und durch den Kompander komprimiert werden und die komprimierten Daten in einem Zielspeicherbereich der komprimierten Transparenz-Datei-Daten in der Speichereinrichtung gespeichert werden.

17. Verfahren gemäß Anspruch 16, wobei die in dem Verbundspeicher gespeicherten Transparenz-Pixeldaten im Rasterformat gespeichert werden und durch den Kompander als eine Quadratmatrix von Pixelblöcken gelesen werden.

18. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens einer Datei unter Verwendung einer objektorientierten Transparenz-Datei (CFO) aufweist, wobei RGB-Pixelbilddaten aus dem Verbundspeicher gelesen werden, mit durch die Graphik-Engine erzeugten RGB-Pixeldaten verbunden werden und in den Verbundspeicher unter den entsprechenden Adressen zurückgeschrieben werden.

19. Verfahren gemäß Anspruch 18, wobei das Verbinden durch von der Graphik-Engine erzeugte Transparenz-Daten gesteuert wird, wobei die Transparenz-Daten in der Form von objektorientierten Daten sind, expandiert in Daten, ausgewählt aus der Gruppe, welche Transparenz-Durchläufe, Transparenz-Blends und Bit-Map-Daten aufweist.

20. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens einer Datei unter Verwendung der Seiten-Transparenz-Datei (CFP) aufweist, wobei RGBM-Pixelbilddaten aus dem Verbundspeicher gelesen werden, mit von der Graphik-Engine erzeugten Daten verbunden werden und in den Verbundspeicher

zurückgeschrieben werden.

21. Verfahren gemäß Anspruch 20, wobei die durch die Graphik-Engine erzeugten RGB-Daten in der Form von RGB-Pixeldaten sind, abgeleitet von den Dateibilddaten, welche zur Graphik-Engine übertragen werden, wobei das Verbinden durch Transparenz-Daten in dem Verbundspeicher gesteuert wird.

22. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens nur einer Transparenz-Datei aufweist (CMO), wobei die Transparenz-Pixeldaten aus dem Verbundspeicher gelesen werden, mit dem von der Graphik-Engine erzeugten Transparenz-Datei-Daten verbunden werden und in den Verbundspeicher zurückgeschrieben werden.

23. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens eines objektorientierten Bilds (COI) aufweist, wobei RGB-Pixelbilddaten aus dem Verbundspeicher gelesen werden, mit von der Graphik-Engine erzeugten RGB-Daten verbunden werden und in den Verbundspeicher zurückgeschrieben werden.

24. Verfahren gemäß Anspruch 23, wobei von der Graphik-Engine erzeugte RGB-Daten in der Form von objektorientierten Daten sind, expandiert in Farbdurchläufe oder Farbblends, wobei das Verbinden durch von der Graphik-Engine erzeugte Transparenz-Daten in der Form von objektorientierten Daten gesteuert wird.

25. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Komprimierens eines Seitenbilds (CPI) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der RGB-Pixelbilddaten in dem Verbundspeicher durch den Kompander komprimiert wird und die komprimierten Daten in einem Zielspeicherbereich für das komprimierte Seitenbild in der Speichereinrichtung gespeichert werden.

26. Verfahren gemäß Anspruch 25, wobei der Verarbeitungsschritt beim Verbinden eines Seitenbilds der Größe A3 810mal ausgeführt wird und beim Verbinden eines Seitenbilds der Größe A4 405mal ausgeführt wird.

27. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Komprimierens einer Seiten-Transparenz-Datei (CPM) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der Transparenz-Pixeldaten in dem Verbundspeicher durch den Kompander komprimiert wird, wobei die komprimierten Transparenz-Datei-Daten in einem Zielspeicherbereich für die komprimierte Seiten-Transparenz-Datei in der Speichereinrichtung gespeichert werden.

28. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Erstellens einer Renderliste (CRL) aufweist, wobei die Anzeigeliste (220) aus einem Speicher einer angeschlossenen Computereinrichtung (200) gelesen wird und als eine Renderliste in der Speichereinrichtung gespeichert wird, wobei die Renderliste durch den Renderprozessor zum Ausführen der Renderoperationen direkt lesbar ist.

29. Verfahren gemäß Anspruch 28, wobei die Anzeigeliste zum Erzeugen der komprimierten Bllddateien führt.

30. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens zu einem Arbeitsbildschirm (CTW) aufweist, wobei RGB-Pixelbilddaten aus einem mit einer Arbeitsbildschirmanzeige (140) verbundenen Arbeitsbildschirmspeicher (370) gelesen werden, mit von der Graphik-Engine erzeugten RGB-Daten verbunden werden und in den Arbeitsbildschirmspeicher zurückgeschrieben werden.

31. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Verbindens unter Verwendung einer Arbeitsbildschirm-Transparenz-Datei (CWM) aufweist, wobei RGBM-Pixeldaten unmittelbar aus einem mit einer Arbeitsbildschirmanzeige (140) verbundenen Arbeitsbildschirmspeicher (370) gelesen werden, mit von der Graphik-Engine erzeugten RGBM-Daten verbunden werden und in den Arbeitsbildschirmspeicher zurückgeschrieben werden.

32. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Zeichnens der Arbeitsbildschirmpixel (DXP) aufweist, wobei eine angeschlossene Computereinrichtung unmittelbar Pixel erzeugt, welche direkt in einen mit einer Arbeitsbildschirmanzeige verbundenen Arbeitsbildschirmspeicher geschrieben werden.

33. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Expandierens eines Dateibilds (EFI) aufweist, wobei eine vorbestimmte Anzahl von Zeilen eines komprimierten Dateibilds von der Speicher-

einrichtung durch den Kompander in RGB-Pixelbilddaten expandiert wird und die RGB-Pixelbilddaten in dem Verbundspeicher gespeichert werden.

34. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Expandierens einer Transparenz-Datei (**EFM**) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der komprimierten Transparenz-Datei-Daten durch den Kompander in Transparenz-Pixeldaten expandiert werden, wobei die Transparenz-Pixeldaten unmittelbar in eine Transparenz-Datei-Ebene des Verbundspeichers geschrieben werden.

35. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Expandierens eines Seitenbilds (**EPI**) aufweist, wobei eine vorbestimmte Anzahl von Zeilen des komprimierten Seitenbilds aus der Speichereinrichtung durch den Kompander in RGB-Pixelbilddaten expandiert werden und die RGB-Pixelbilddaten direkt in den Verbundspeicher geschrieben werden.

36. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Expandierens einer Seiten-Transparenz-Datei (**EPM**) aufweist, wobei eine vorbestimmte Anzahl von Zeilen der komprimierten Seiten-Transparenz-Daten aus der Speichereinrichtung durch den Kompander in Transparenz-Pixeldaten expandiert werden und die Transparenz-Pixeldaten direkt in eine Transparenz-Ebene und in den Verbundspeicher geschrieben werden.

37. Verfahren gemäß Anspruch 7, wobei der Kompander die adaptive, diskrete Kosinustransformation gemäß den Technischen Spezifikationen zu JPEG ausführt.

38. Verfahren gemäß Anspruch 37, wobei der Kompander in den komprimierten Bilddaten auch eine Texterfassungsmatrix erzeugt, um die Texterfassung zuzulassen, und Markierungskodes am Ende jedes Bands von komprimierten Bilddaten einfügt werden.

39. Verfahren gemäß Anspruch 38, wobei das Verfahren den Schritt des Filterns der komprimierten Bilddaten zum JPEG-Format (**FAJ**) aufweist, wobei die Texterfassungsmatrix verworfen wird.

40. Verfahren gemäß Anspruch 38, wobei das Verfahren den Schritt des Filterns der JPEG-Dateidaten in komprimierte Bilddaten (**FJA**) aufweist, wobei die Texterfassungsmatrix gelöscht wird, um so anzuzeigen, daß jede Zelle der Matrix behandelt wird, als ob sie eine Bildzelle wäre und nicht eine Textzelle, und Markierungskodes am Ende jedes Bands eingefügt werden.

41. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Formatierens eines Dateibilds (**FFI**) aufweist, wobei der Renderprozessor einen Anfangsblockbefehl für die Graphik-Engine erzeugt, welcher der Graphik-Engine zugeleitet wird, um eine Anzahl von zu verbindenden Pixeln, eine Startpixeladresse und einen Verbundmodus zu spezifizieren.

42. Verfahren gemäß Anspruch 41, wobei RGB-Pixeldaten aus einem Pufferspeicherbereich (**395**) der Speichereinrichtung zum Renderprozessor übertragen werden, um RGB-Pixelbilddaten als Eingabe für die Graphik-Engine bereitzustellen.

43. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Formatierens eines Dateibilds und einer Transparenz-Datei (**FIM**) aufweist, wobei der Renderprozessor einen Anfangsblockbefehl für die Graphik-Engine erzeugt, welcher der Graphik-Engine zugeleitet wird, um eine Anzahl von zu verbindenden Pixeln, eine Startpixeladresse und einen Verbundmodus zu spezifizieren.

44. Verfahren gemäß Anspruch 41, wobei RGBM-Pixelbilddaten aus einem Pufferspeicherbereich (**395**) der Speichereinrichtung zum Renderprozessor übertragen werden, um RGBM-Pixelbilddaten als Eingabe für die Graphik-Engine bereitzustellen.

45. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des schnellen Schreibens eines Dateibilds (**FWI**) aufweist, wobei eine vorbestimmte Anzahl von Zeilen des komprimierten Dateibilds in dem Speicher durch den Kompander in RGB-Pixelbilddaten expandiert wird und in den Verbundspeicher geschrieben wird.

46. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Vorliegens des Verarbeitungsschritts des Ladens von Huffman-Tabellen für das Komprimieren (**LHC**) aufweist, wobei Huffman-Tabellen

(380), welche für die adaptive, diskrete Kosinustransformationskompression der Pixelbilddaten erforderlich sind, in der Speichereinrichtung gespeichert werden und vor der Kompressionsverarbei-tung aus der Speichereinrichtung in den Kompander geladen werden.

47. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Ladens von Huffman-Tabellen für das Expandieren **(LHE)** aufweist, wobei die Huffman-Tabellen **(380)**, welche für die adaptive, diskrete Kosinustransformationsexpansion der komprimierten Bilddaten erforderlich sind, in der Speichereinrichtung gespeichert werden und vor der Expansionsverarbeitung aus der Speichereinrichtung in den Kompander übertragen werden.

48. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Druckens **(PRN)** aufweist, wobei die komprimierten Seitenbilddaten von der Speichereinrichtung durch den Kompander expandiert werden und als Pixelbilddaten in den Verbundspeicher geschrieben werden, wobei die Pixelbilddaten vom Verbundspeicher für eine Druckeinrichtung **(154)** für das Seitenbild gepuffert werden.

49. Verfahren gemäß Anspruch 48, wobei die RGB-Pixelbilddaten in Magenta-, Cyan-, Yellow- und Schwarzbilddaten für die Eingabe in die Druckeinrichtung umgewandelt werden.

50. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt eines schnellen Software-Zooms **(QSZ)** aufweist, wobei die Graphik-Engine eine vorbestimmte Anzahl von Zeilen der RGBM-Pixelbilddaten über den Renderprozessor aus einem Pufferspeicherbereich der Speichereinrichtung liest, wobei die Graphik-Engine eine Zoom-Version der Pixelbilddaten für die Anzeige auf einem angeschlossenen Arbeitsbildschirm **(140)** erzeugt.

51. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Lesens einer komprimierten Datei von der Plattenspeichereinrichtung **(RAD)** aufweist, wobei eine komprimierte Bilddatei auf einer Festplatte **(120)** gespeichert wird, welche mit einer Computereinrichtung **(200)** verbunden ist, wobei die komprimierte Bilddatei durch die Computereinrichtung von der Festplatte gelesen wird und in einen Speicherbereich in der Speichereinrichtung übertragen wird.

52. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des erneuten Einstellens der Größe einer komprimierten Bilddatei **(RAF)** aufweist, wobei der Renderprozessor eine vorbestimmte Anzahl von Zeilen der RGBM-Pixeldaten aus einem Pufferspeicherbereich **(395)** der Speichereinrichtung liest und eine in der Größe erneut eingestellte Version der Daten unter Verwendung einer bilinearen Abtastratenumsetzung erzeugt und die in der Größe erneut eingestellte Version in den Pufferspeicherbereich zurückgeschrieben wird.

53. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Renderns eines Bands der Objekt-Transparenz-Datei **(RBM)** aufweist, wobei eine Renderliste von Graphikbefehlen in der Speichereinrichtung bereitgestellt wird und durch den Renderprozessor gelesen wird, wobei der Renderprozessor eine Serie von Graphik-Engine-Befehlen für die Graphik-Engine für das Rendern von Transparenz-Pixeldaten erzeugt.

54. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Renderns eines Bands von Objekten **(RBO)** aufweist, wobei eine in der Speichereinrichtung gespeicherte Renderliste **(397)** durch den Renderprozessor interpretiert wird, um Graphik-Engine-Befehle für die Graphik-Engine zum Rendern eines Bands von Objekten zu erzeugen.

55. Verfahren gemäß Anspruch 54,
dadurch gekennzeichnet, daß Schriftsatzbeschreibungen **(399)**, welche für Text erforderlich sind, in der Speichereinrichtung verfügbar sind und auch dem Renderprozessor eingegeben werden.

56. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Lesens einer Anzeigeliste von der Plattenspeichereinrichtung **(RDD)** aufweist, wobei die angeschlossene Computereinrichtung **(200)** eine Plattenspeichereinrichtung **(120)** aufweist und die Anzeigeliste **(220)** zur Übertragung an den Renderprozessor von der Plattenspeichereinrichtung in die Computereinrichtung eingelesen wird.

57. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Aufnehmens einer Anzeigeliste von einem Netzwerk **(RDE)** aufweist, wobei eine angeschlossene Computereinrichtung **(200)** mit einem Kommunikationsnetzwerk **(105)** verbunden ist, in welche eine Anzeigeliste **(220)** zum Übertragen vom Kommunikationsnetzwerk zum Renderprozessor in die Computereinrichtung eingelesen wird.

58. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Renderns einer Transparenz-Datei mit einem Dateibild (RMF) aufweist, wobei der Renderprozessor eine in der Speichereinrichtung gespeicherte Renderliste (397) in Graphik-Engine-Befehle umsetzt, welche der Graphik-Engine eingegeben werden, wobei die Graphik-Engine die RGB-Pixelbilddaten aus einem Pufferspeicherbereich (395) der Speichereinrichtung über den Renderprozessor aufnimmt und die Graphik-Engine RGBM-Pixeldaten ausgibt.

59. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Abtastens (SCN) aufweist, wobei eine Bildabtasteinrichtung (152) RGB-Pixelbilddaten eines abgetasteten Seitenbilds, welches in dem Verbundspeicher gepuffert wird, bereitstellt, wobei die vom Verbundspeicher gepufferten Pixelbilddaten dem Kompander zugeführt werden und zum Speichern als ein komprimiertes Seitenbild in der Speichereinrichtung komprimiert werden.

60. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Abtastens zu einem Arbeitsbildschirm (STW) aufweist, wobei eine Bildabtasteinrichtung (152) RGB-Pixelbilddaten eines abgetasteten Seitenbilds erzeugt, welche in dem Verbundspeicher gepuffert werden, wobei die Pixelbilddaten von dem Verbundspeicher in einer mit einem Arbeitsbildschirm (140) zum Anzeigen der Pixelbilddaten verbundenen Anzeigespeichereinrichtung (370) gepuffert werden.

61. Verfahren gemäß Anspruch 60, wobei eine Schwenk-/Zoom-Steuereinrichtung (350), welche zwischen dem Verbundspeicher und dem Anzeigespeicher verbunden ist, das Erhöhen des Bilds für die Anzeige auf der Arbeitsbildschirmanzeige zuläßt.

62. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Schreibens eines komprimierten Bilds in die Plattenspeichereinrichtung (WAD) aufweist, wobei die komprimierten Bilddaten aus der Speichereinrichtung gelesen und zu einer angeschlossenen Computereinrichtung (200) übertragen werden sowie in einer mit der Computereinrichtung verbundenen Plattenspeichereinrichtung (120) gespeichert werden.

63. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Schreibens einer Anzeigeliste in eine Plattenspeichereinrichtung (WDD) aufweist, wobei eine angeschlossene Computereinrichtung (200) einen Satz von Anzeigelisten (220) erzeugt und die Anzeigelisten von der Computereinrichtung in eine mit dieser verbundene Plattenspeichereinrichtung (120) zum Speichern übertragen werden.

64. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des direkten Renderns der Objekte (XRO) aufweist, wobei eine angeschlossene Computereinrichtung (200) unmittelbar Graphik-Engine-Befehle erzeugt, welche von der Computereinrichtung über den Renderprozessor zur Graphik-Engine zum Rendern der Objekte übertragen werden.

65. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bildverarbeitungsschritt des Zoomens zu einem Arbeitsbildschirm (ZTW) aufweist, wobei die komprimierten Seitenbilddaten von der Speichereinrichtung durch den Kompander expandiert werden und als Pixelbilddaten zum Verbundspeicher übertragen werden, wobei die Pixelbilddaten zur Graphik-Engine übertragen werden, um die Daten in eine Schwenk/Zoom-Steuereinrichtung (350) zu schreiben, wobei die Schwenk-/Zoom-Steuereinrichtung die Daten vor dem Übertragen der Daten zu einem mit einer Arbeitsbildschirmanzeige (140) verbundenen Anzeigespeicher (370) erhöht.

66. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens der Schichten der Objekte mit einem komprimierten Bild aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (CDL),
(ii) Erstellen einer Renderliste (CRL) aus der Anzeigeliste,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iii) gleichzeitiges Rendern eines Bands von Objekten und Laden der Huffman-Tabellen für das Expandie ren (LHE),
(iv) gleichzeitiges Rendern eines Bands von Objekten (RBO) und Expandieren eines Seitenbilds (EPI) von der Speichereinrichtung,
(v) Rendern eines Bands eines ersten Objekts, Laden der Huffman-Tabellen für das Komprimieren (LHC) und

Verbinden des objektorientierten Bilds **(COI)**,
(vi) für jedes weitere Objekt des zu erzeugenden Bilds Rendern eines Bands des weiteren Objekts und Verbinden des objektorientierten Bilds, und
(vii) Komprimieren eines Bands des Seitenbilds **(CPI)**.

67. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens einer Datei unter Verwendung einer Bild-Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste **(CRL)** aus der Anzeigeliste,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,
(iv) Expandieren eines Bands eines Seitenbilds **(EPI)**,
(v) Expandieren eines Bands eines Dateibilds **(EFI)**,
(vi) Expandieren eines Bands einer Transparenz-Datei **(EFM)**,
(vii) Puffern des Bands des Dateibilds und der Trans parenz-Datei **(BIM)**,
(viii) Formatieren eines Bands des Dateibilds und der Transparenz-Datei **(FIM)**,
(ix) gleichzeitiges Laden der Huffman-Tabellen für das Komprimieren **(LHC)** und Verbinden des Bands des Dateibilds unter Verwendung der Transparenz Datei **(CFF)** und
(x) Komprimieren eines Bands des Dateibilds **(CFF)**.

68. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens einer Datei unter Verwendung einer Seiten-Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste aus der Anzeigeliste **(CRL)**,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,
(iv) Expandieren eines Bands eines Seitenbilds **(EPI)**,
(v) Expandieren eines Bands einer Seiten-Transparenz-Datei **(EPM)**,
(vi) Expandieren eines Bands eines Dateibilds **(EFI)**,
(vii) Puffern des Bands des Dateibilds **(BFI)**,
(viii) Formatieren eines Bands des Dateibilds **(FFI)**,
(ix) gleichzeitiges Laden der Huffman-Tabellen für das Komprimieren **(LHC)** und Verbinden des Bands des Dateibilds mit der Seiten-Transparenz-Datei **(CFP)** und
(x) Komprimieren eines Bands des Seitenbilds **(CPI)**.

69. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens einer Datei unter Verwendung sowohl der Seiten-Transparenz-Datei als auch der Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste **(CRL)** aus der Anzeigeliste,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,
(iv) Expandieren eines Bands eines Seitenbilds **(EPI)**,
(v) Expandieren eines Bands einer Seiten-Transpa renz-Datei **(EPM)**,
(vi) Expandieren eines Bands eines Dateibilds **(EFI)**,
(vii) Expandieren eines Bands einer Transparenz-Datei **(EFM)**,
(viii) Puffern des Bands des Dateibilds und der Trans parenz-Datei **(BIM)**,

(ix) Formatieren eines Bands des Dateibilds und der Transparenz-Datei (**FIM**),
(x) gleichzeitiges Laden der Huffman-Tabellen zum Komprimieren (**LHC**) und Verbinden unter Verwendung sowohl der Transparenz-Datei als auch der Bild-Transparenz-Datei (**CBM**) und
(xi) Komprimieren eines Bands des Seitenbilds (**CPI**).

70. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß nur des Druckens der Objektgraphik und des Texts aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (**CDL**),
(ii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),
(iii) Laden der Huffman-Tabellen für das Komprimieren (**LHC**),

Wiederholen der Schritte (iv) bis (vii) für jedes Band des Bilds:

(iv) Rendern eines Bands von Objekten (**RBO**) und Löschen des Verbundspeichers (**CCB**),
(v) gleichzeitiges Rendern eines Bands eines ersten Objekts (**RBO**) und Verbinden dieses Bands des Seitenbilds (**COI**),
(vi) Wiederholen des Schritts (v) für jedes weitere Objekt des Seitenbilds,
(vii) Komprimieren des Bands des Seitenbilds (**CPI**) und nachfolgend Abschließen des Schritts (vii) für das letzte Band:
(viii) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(ix) Drucken des gesamten Bilds (**PRN**).

71. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Druckens eines vorliegenden Seitenbilds aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(ii) Drucken des Seitenbilds (**PRN**).

72. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Druckens eines komprimierten Bild mit der Transparenz-Datei und der Graphik aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (**CDL**),
(ii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),

Wiederholen der Schritte (iii) bis (xi) für jedes Band des Bilds:

(iii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Löschen des Verbundspeichers (**CCB**) und Laden der Huffman-Tabellen für das Expandieren (**LHE**),
(iv) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands eines Dateibilds (**EFI**),
(v) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands der Transparenz-Datei (**EFM**),
(vi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Puffern des Dateibilds und der Trans parenz-Datei (**BIM**),
(vii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Formatieren des Dateibilds und der Transparenz-Datei (**FIM**),
(viii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Laden der Huffman-Tabellen zum Komprimieren (**LHC**) und Verbinden des Bands der Datei unter Verwendung der Transparenz-Datei (**CFF**),
(ix) Verbinden des Bands des objektorientierten Bilds (**COI**),
(x) Komprimieren des Bands des Seitenbilds (**CPI**) und

nachfolgend das Abschließen des Schritts (xii) für das letzte Band:

(xi) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(xii) Drucken des Seitenbilds (**PRN**).

73. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Druckens von zwei Bildern mit Objekt-Transparenz-Dateien und Text aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (**CDL**),
(ii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),

Wiederholen der Schritte (iii) bis (xiii) für jedes Band des Bilds:

(iii) gleichzeitiges Rendern eines Bands der Objekt-Transparenz-Datei (**RBM**), Löschen des Verbundspeichers (**CCB**) und Laden der Huffman-Tabellen zum Expandieren (**LHE**),
(iv) gleichzeitiges Rendern eines Bands der Objekt-Transparenz-Datei (**RBM**) und Expandieren eines Bands eines ersten Dateibilds,
(v) gleichzeitiges Rendern eines Bands der Objekt-Transparenz-Datei und Puffern des Bands des ersten Dateibilds (**EFI**),
(vi) Rendern eines Bands der objektorientierten Transparenz-Datei mit dem Band des ersten Dateibilds (**RMF**),
(vii) gleichzeitiges Rendern eines Bands der objektorientierten Transparenz-Datei (**RBM**) und Verbinden des Bands des ersten Dateibilds mit der objektorientierten Transparenz-Datei (**CFO**),
(viii) gleichzeitiges Rendern eines Bands der objektorientierten Transparenz-Datei (**RBM**) und Expandieren eines Bands des zweiten Dateibilds (**EFI**),
(ix) gleichzeitiges Rendern eines Bands der Objekt-Transparenz-Datei (**RBM**) und Puffern des Bands des zweiten Dateibilds (**BFI**),
(x) Rendern eines Bands der objektorientierten Transparenz-Datei für das zweite Dateibild (**RMF**),
(xi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Laden der Huffman-Tabellen zum Komprimieren (**LHC**) und Verbinden des Bands des zweiten Dateibilds mit dessen Transparenz-Datei (**CFO**),
(xii) Verbinden eines Bands des objektorientierten Textbilds (**COI**),
(xiii) Komprimieren des Bands des Seitenbilds (**CPI**) und

nachfolgendes Abschließen des Schritts (xiii) für das letzte Band:

(xiv) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(xv) Drucken des Seitenbilds (**PRN**).

74. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Druckens von zwei Bildern mit Transparenz-Dateien und Text aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Laden der Huffman-Tabellen zum Expandieren (**LHE**) und Löschen des Verbundspeichers (**CCB**),
(ii) Erstellen einer Anzeigeliste (**CDL**),
(iii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),

Wiederholen der Schritte (iv) bis (xvi) für jedes Band des Bilds:

(iv) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Löschen des Verbundspeichers (**CCB**) und Laden der Huffman-Tabellen für das Expandieren (**LHE**),
(v) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands eines ersten Dateibilds (**EFI**),
(vi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands einer ersten Transparenz-Datei (**EFM**),
(vii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Puffern des Bands des ersten Datei bilds und der ersten Transparenz-Datei (**BIM**),
(viii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Formatieren des Bands des Dateibilds und der Transparenz-Datei (**FIM**),
(ix) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Verbinden des Bands des ersten Dateibilds unter Verwendung der ersten Transparenz-Datei (**CIM**),
(x) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands eines zweiten Dateibilds (**EFI**),

(xi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Verbinden des Bands des ersten Dateibilds unter Verwendung der ersten Transparenz-Datei (**CFM**),
(x) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands eines zweiten Dateibilds (**EFI**),
(xi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Expandieren eines Bands einer zweiten Transparenz-Datei (**EFM**),
(xii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Puffern des Bands des zweiten Datei bilds und des Bands der zweiten Transparenz-Datei (**BIM**),
(xiii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und Formatieren des zweiten Dateibilds und der Transparenz-Datei (**FIM**),
(xiv) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Laden der Huffman-Tabellen für das Komprimieren (**LHC**) und Verbinden des Bands des zweiten Dateibilds und dessen Transparenz-Datei (**CFM**),
(xv) Verbinden eines Bands des objektorientierten Bildtexts (**COI**),
(xvi) Komprimieren des Bands des Seitenbilds (**CPI**) und

nachfolgendes Abschließen des Schritts (xvi) für das letzte Band:

(xvii) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(xviii) Drucken des Seitenbilds (**PRN**).

75. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Druckens von drei opaken, rechteckigen Bildern und von Text aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (**CDL**),
(ii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),

Wiederholen der Schritte (iii) bis (viii) für jedes Band des Bilds:

(iii) gleichzeitiges Rendern eines Bands von Objekten (**RBO**), Löschen des Verbundspeichers (**CCB**) und Laden der Huffman-Tabellen für das Expandieren (**LHE**),
(iv) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und schnelles Schreiben eines Bands eines ersten Dateibilds in den Verbundspeicher (**FWI**),
(v) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und schnelles Schreiben eines Bands eines zweiten Dateibilds in den Verbundspeicher (**FWI**),
(vi) gleichzeitiges Rendern eines Bands von Objekten (**RBO**) und schnelles Schreiben eines Bands eines dritten Dateibilds in den Verbundspeicher (**FWI**),
(vii) gleichzeitiges Laden der Huffman-Tabellen zum Komprimieren (**LHC**) und Komprimieren eines Bands des Seitenbilds vom Verbundspeicher (**COI**) und
(viii) Komprimieren des Bands des Seitenbilds (**CPI**),

nachfolgendes Abschließen des Schritts (viii) für das letzte Band:

(ix) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(x) Drucken des Seitenbilds (**PRN**).

76. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsschritt des Zoomens zu einem Arbeitsbildschirm aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Laden der Huffman-Tabellen für das Expandieren (**LHE**) und
(ii) Zoomen zu einem Arbeitsbildschirm (**ZTW**).

77. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens der Graphik zu einem Arbeitsbildschirm aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste (**CDL**),
(ii) Erstellen einer Renderliste aus der Anzeigeliste (**CRL**),

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iii) Rendern eines Bands von Objekten **(RBO)**,
(iv) gleichzeitiges Rendern eines Bands eines ersten Objekts **(RBO)** und Verbinden des Bands zum Arbeitsbildschirm **(CTW)**,
(v) Wiederholen des Schritts (iv) für jedes weitere Objekt des Bilds,
(vi) Verbinden des Bands zum Arbeitsbildschirm **(CTW)**.

78. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens einer Datei zu einem Arbeitsbildschirm unter Verwendung einer Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste aus der Anzeigeliste **(CRL)**,
(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iv) Expandieren eines Bands des Dateibilds **(EFI)**,
(v) Expandieren eines Bands der Transparenz-Datei **(EFM)**,
(vi) Puffern des Bands des Dateibilds und des Bands der Transparenz-Datei **(BIM)**,
(vii) Ausführen eines schnellen Software-Zooms am gepufferten Band **(QSZ)**,
(viii) Formatieren des Bands des Dateibilds und der Transparenz-Datei **(FIM)** und
(ix) Verbinden des Bands zum Arbeitsbildschirm **(CTN)**.

79. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Schreibens eines Dateibilds zu einem Arbeitsbildschirm ohne eine Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste aus der Anzeigeliste **(CRL)**,
(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,

Wiederholen des folgenden Schritts für jedes Band des Bilds:
(iv) Zoomen des Bands zum Arbeitsbildschirm **(ZTW)**.

80. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Verbindens eines Dateibilds zu einem Arbeitsbildschirm unter Verwendung einer Objekt-Transparenz-Datei aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Erstellen einer Anzeigeliste **(CDL)**,
(ii) Erstellen einer Renderliste aus der Anzeigeliste **(CRL)**,
(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,

Wiederholen der folgenden Schritte für jedes Band des Bilds:

(iv) Expandieren eines Bands des Dateibilds **(EFI)**,
(v) Puffern des Bands des Dateibilds **(BFI)**,
(vi) Ausführen eines schnellen Software-Zooms auf dem Band des Dateibilds **(QSZ)**,
(vii) Rendern eines Bands der Transparenz-Datei mit dem Band des Dateibilds **(RMF)** und
(viii) Verbinden des Bands zum Arbeitsbildschirm **(CTW)**.

81. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Ausführens einer Testabtastung aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Laden der Huffman-Tabellen für das Komprimieren **(LHC)** und
(ii) Abtasten der Bilddaten zum Arbeitsbildschirm **(STW)**.

82. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Abtastens eines Seitenbilds aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Prozeßschritte aufweist:

(i) Laden der Huffman-Tabellen für das Komprimieren **(LHC)** und
(ii) Abtasten des Seitenbilds **(SCN)**.

83. Verfahren gemäß Anspruch 7, wobei das Verfahren den Bilderzeugungsprozeß des Abtastens, Trimmens und Archivierens eines Seitenbilds aufweist, wobei der Bilderzeugungsprozeß die aufeinanderfolgenden Verarbeitungsschritte aufweist:

(i) Laden der Huffman-Tabellen für das Komprimieren **(LHC)**,
(ii) Abtasten des Seitenbilds **(SCN)**,

Wiederholen der Schritte (iii) bis (vi) für jedes Band des Bilds:

(iii) Laden der Huffman-Tabellen für das Expandieren **(LHE)**,
(iv) Expandieren eines Bands des Dateibilds **(EFI)**,
(v) Laden der Huffman-Tabellen für das Komprimieren **(LHC)**,
(vi) Komprimieren des Bands des Dateibilds **(CFI)**,

nachfolgendes Abschließen des Schritts **(vi)** für das letzte Band:
(vii) Schreiben der komprimierten Daten in eine nicht-flüchtige Speichereinrichtung **(WAD)**.

84. Desk-Top-Publishing-System zur Verwendung des Verfahrens zum Erzeugen eines Bilds gemäß einem der vorhergehenden Ansprüche, wobei das System eine Speichereinrichtung **(340)** aufweist, welche angepaßt ist, die komprimierten Bilddaten als eine Vielzahl von Bändern zu speichern,
gekennzeichnet durch Einrichtungen **(310, 320, 330, 340)** zum Erzeugen und Aufbereiten des Bilds unter Anwendung mehrfacher, aufeinanderfolgender Durchläufe über die Bänder, wobei jeder Durchlauf verwendet wird, um ein Band zu komprimieren und das Band zu speichern.

Revendications

1. Procédé de création d'image dans lequel ladite image est formée d'une pluralité de bandes, lesdites bandes étant stockées sous forme de données d'images compressées, caractérisé en ce qu'il comprend au moins une des étapes suivantes :

formation de ladite image par passes séquentielles multiples sur lesdites bandes, chacune desdites bandes étant compressée et stockée au cours de la passe correspondante ; et
édition de ladite image par passes séquentielles multiples sur lesdites bandes, chacune desdites bandes étant compressée et stockée au cours de la passe correspondante.

2. Procédé selon la revendication 1, ledit procédé étant caractérisé en ce que :

(a) la pluralité de bandes est formée comme suit :

(1) création d'une bande de l'image à partir d'objets figurant dans une liste d'affichage (220)
(2) compression de la bande de l'image ;
(3) stockage de la bande compressée de l'image ; et
(4) répétition des étapes (1) à (3) pour chaque bande de l'image

(b) édition d'une bande sélectionnée de l'image par :

(1) expansion de la bande sélectionnée de l'image stockée ;
(2) création d'une bande supplémentaire de l'image à partir d'objets supplémentaires figurant dans ladite liste d'affichage
(3) composition de la bande supplémentaire avec la bande sélectionnée pour constituer une bande sélectionnée et éditée de l'image ;

(4) compression de la bande sélectionnée et éditée de l'image ;
(5) stockage de la bande sélectionnée, éditée et compressée ;

(c) répétition des étapes (b) (1) à (b) (5) pour chaque bande de l'image ; et
(d) répétition des étapes (b) et (c) en fonction de l'exigence de création d'une image finale éditée.

3. Procédé selon la revendication 2, dans lequel les bandes sélectionnées le sont consécutivement sur ladite image.

4. Procédé selon la revendication 2 ou 3, dans lequel ledit procédé comprend les étapes supplémentaires suivantes :

(e) expansion des bandes de l'image éditée finale ; et
(f) affichage des bandes développées pour reproduire l'image éditée finale.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel on applique des procédés de transformation en cosinus discret adaptative pour comprimer et développer les bandes de l'image.

6. Procédé selon la revendication 5, dans lequel lesdits procédés de transformation en cosinus discret adaptative sont mis en oeuvre conformément aux spécifications techniques ISO/IEC JTC1/SC2/WG8 JPEG.

7. Procédé selon l'une quelconque des revendications précédentes 2 à 6, dans lequel lesdites étapes de création et d'expansion produisent des données d'images de pixels rouge (R), vert (G), bleu (B) et de masque (M) traitées par lesdites étapes de composition et de compression, lesdites étapes de création étant exécutées par un processeur de rendu (310), lesdites étapes de composition étant réalisées par un moteur graphique (320) et une mémoire de composition associée (330), lesdites étapes de compression et d'expansion étant exécutées par un compresseur-expanseur (415) et lesdites données d'images étant stockées dans un moyen de mémorisation associé (390, 420).

8. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à mettre en mémoire tampon une image de fichier (BFI) dans lequel une bande de données d'images de pixels RGB est transférée de ladite mémoire de composition vers un emplacement de tampon (395) dudit moyen de mémorisation.

9. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à mettre en mémoire tampon une image de fichier et un masque (BIM), dans lequel une bande de données d'images de pixels RGBM est transférée de ladite mémoire de composition vers un emplacement de tampon (395) dudit moyen de mémorisation.

10. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer au moyen des deux masques (CBM), dans lequel les données d'images de pixels RGBM sont lues à partir de ladite mémoire de composition, composées avec les données d'images de pixels RGBM générées par ledit moteur graphique et réécrites dans ladite mémoire de composition, l'opération de composition étant commandée par la combinaison de données de masque figurant dans ladite mémoire de composition et de données de transparence générées par ledit moteur graphique.

11. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à effacer la mémoire de composition(CCB), dans lequel des bandes de données d'images de pixels blancs opaques sont générées par ledit moteur graphique et écrites dans ladite mémoire de composition.

12. Procédé selon la revendication 7, dans lequel ledit procédé comprend l'étape de traitement d'image consistant à créer une liste d'affichage (CDL) dans un moyen de calcul (200) connecté audit moyen de processeur de rendu, ladite liste d'affichage étant composée de données décrivant l'image sélectionnée dans le groupe constitué d'objets graphiques, de texte et de données d'images compressées.

13. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer un fichier en utilisant un masque de fichier (CFF), dans lequel les données de pixels RGB sont lues dans ladite mémoire de composition, composées avec les données de masque générées par ledit moteur graphique et réécrites dans ladite mémoire de composition.

14. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'images consistant à

compresser une image de fichier (CFI), dans lequel un nombre prédéterminé de lignes de données d'images de pixels RGB est lu dans ladite mémoire de composition, compressé par ledit compresseur-expanseur et écrit dans un emplacement destinataire d'image compressée dudit moyen de mémorisation.

15. Procédé selon la revendication 14, dans lequel lesdites données d'images de pixels sont stockées dans ladite mémoire de composition en format de trame et lues par ledit compresseur-expanseur sous forme d'un réseau carré de blocs de pixels.

16. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à compresser un masque de fichier (CFM), dans lequel un nombre prédéterminé de lignes de données de pixels de masque est lu dans ladite mémoire de composition et compressé par ledit compresseur-expanseur, les données compressées étant stockées dans un emplacement destinataire de masque compressé dudit moyen de mémorisation.

17. Procédé selon la revendication 16, dans lequel lesdites données de pixels de masque stockées dans ladite mémoire de composition sont en format de trame et sont lues par ledit compresseur-expanseur sous forme d'un réseau carré de blocs de pixels.

18. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer un fichier en utilisant un masque d'objets (CFO), dans lequel les données d'images de pixels RGB sont lues dans ladite mémoire de composition, composées avec les données de pixels RGB générées par ledit moteur graphique, et réécrites dans la mémoire de composition aux adresses correspondantes.

19. Procédé selon la revendication 18, dans lequel ladite composition est commandée par des données de transparence générées par ledit moteur graphique, lesdites données de transparence étant sous forme de données à base d'objets développées en données sélectionnées dans le groupe comprenant des séries de transparents, des mélanges de transparents et des données en mode point.

20. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer un fichier en utilisant un masque de page (CFP), dans lequel les données d'images de pixels RGB sont lues dans ladite mémoire de composition, composées avec les données générées par ledit moteur graphique et réécrites dans ladite mémoire de composition.

21. Procédé selon la revendication 20, dans lequel lesdites données RGB générées par ledit moteur graphique sont sous forme de données de pixels RGB provenant des données d'images de fichier transférées audit moteur graphique, ladite composition étant commandée par des données de masque figurant dans ladite mémoire de composition.

22. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer uniquement un masque (CMO) dans lequel les données de pixels de masque sont lues dans ladite mémoire de composition, composées avec les données de masque générées par ledit moteur graphique et réécrites dans ladite mémoire de composition.

23. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer une image à base d'objets (COI), dans lequel les données d'images de pixels RGB sont lues dans ladite mémoire de composition, composées avec les données RGB générées par ledit moteur graphique et réécrites dans ladite mémoire de composition.

24. Procédé selon la revendication 23, dans lequel lesdites données RGB générées par ledit moteur graphique sont sous forme de données à base d'objets développées en séries de couleurs ou mélanges de couleurs, ladite composition étant commandée par des données de transparence générées par ledit moteur graphique sous forme de données à base d'objets.

25. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à compresser une image de page (CPI), dans lequel un nombre prédéterminé de lignes de données d'images de pixels RGB se trouvant dans ladite mémoire de composition est compressé par ledit compresseur-expanseur, les données compressées étant stockées dans un emplacement destinataire d'image de page compressée dudit moyen de mémorisation.

26. Procédé selon la revendication 25, dans lequel ladite étape de traitement est exécutée 810 fois lors de la composition d'une image de page au format A3 et 405 fois lors de la composition d'une image de page au format A4.

27. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à compresser un masque de page (CPM) dans lequel un nombre prédéterminé de lignes de données de pixels de masque se trouvant dans ladite mémoire de composition est compressé par ledit compresseur-expanseur, dans lequel lesdites données de masque compressées sont stockées dans un emplacement destinataire de masque de page compressée dudit moyen de mémorisation.

28. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à créer une liste de rendu (CRL), dans lequel ladite liste d'affichage est lue à partir d'une mémoire (220) d'un moyen de calcul associé (200) et stockée sous forme de liste de rendu dans ledit moyen de mémorisation, ladite liste de rendu étant lisible directement par ledit processeur de rendu pour exécuter les opérations de rendu.

29. Procédé selon la revendication 28, dans lequel ladite liste d'affichage entraîne la création de fichiers d'images compressées.

30. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer sur un écran de travail (CTW), dans lequel les données d'images de pixels RGB sont lues à partir d'une mémoire d'écran de travail (370) associée à un affichage d'écran de travail (140), composées avec les données RGB générées par ledit moteur graphique, et réécrites dans ladite mémoire d'écran de travail.

31. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à composer, au moyen d'un masque d'écran de travail (CWM), dans lequel les données de pixels RGBM sont lues directement à partir d'une mémoire d'écran de travail (370) associée à un affichage d'écran de travail (140), composées avec les données RGBM générées par ledit moteur graphique et réécrites dans ladite mémoire d'écran de travail.

32. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à tracer des pixels sur l'écran de travail (DXP), dans lequel un moyen de calcul associé génère directement des pixels qui sont écrits directement dans une mémoire d'écran de travail associée à un affichage d'écran de travail.

33. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à développer une image de fichier (EFI), dans lequel un nombre prédéterminé de lignes d'une image de fichier compressée est développé à partir dudit moyen de mémorisation par ledit compresseur-expanseur en données d'images de pixels RGB, les données d'images de pixels RGB étant stockées dans ladite mémoire de composition.

34. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à développer un masque de fichier (EFM), dans lequel un nombre prédéterminé de lignes de données de masque de fichier compressé est développé en données de pixels de masque par ledit compresseur-expanseur, lesdites données de pixels de masque étant écrites directement dans un plan de masque de ladite mémoire de composition.

35. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à développer une image de page (EPI), dans lequel un nombre prédéterminé de lignes d'image de page compressée est développé à partir dudit moyen de mémorisation par ledit compresseur-expanseur en données d'images de pixels RGB, les données d'images de pixels RGB étant écrites directement dans ladite mémoire de composition.

36. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à développer un masque de page (EPM), dans lequel un nombre prédéterminé de lignes de données de masque de page compressée est développé en données de pixels de masque, à partir dudit moyen de mémorisation par ledit compresseur-expanseur, lesdites données de pixels de masque étant écrites directement dans un plan de masque et dans ladite mémoire de composition.

37. Procédé selon la revendication 7, dans lequel ledit compresseur-extenseur exécute une transformation en cosinus discret adaptative conformément aux spécifications techniques JPEG.

38. Procédé selon la revendication 37, dans lequel ledit compresseur-expanseur crée, en outre, dans lesdites données d'images compressées, un réseau de détection de texte pour permettre la détection de texte, et des codes de

marquage insérés à la fin de chaque bande de données d'images compressées.

39. Procédé selon la revendication 38, dans lequel ledit procédé comprend l'étapo consistant à filtrer des données d'images compressées au format JPEG (FAJ), dans lequel le réseau de détection de texte est éliminé.

40. Procédé selon la revendication 38, dans lequel ledit procédé comprend l'étape consistant à filtrer les données de fichier JPEG pour obtenir des données d'images compressées (FGA), dans lequel ledit réseau de détection de texte est effacé pour indiquer que chaque cellule dudit réseau est traitée comme s'il s'agissait d'une cellule d'image et non pas d'une cellule de texte, et à insérer des codes de marquage à la fin de chaque bande.

41. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à formater une image de fichier (FFI)), dans lequel ledit processeur de rendu crée une commande en-tête pour ledit moteur graphique, qui est écrite dans ledit moteur graphique et indique un nombre de pixels à composer, une adresse de pixel de début, et un mode de composition.

42. Procédé selon la revendication 41, dans lequel les données de pixels RGB sont transférées entre un emplacement de tampon (395) dudit moyen de mémorisation et ledit processeur de rendu pour fournir des données d'images de pixels RGB à l'entrée dudit moteur graphique.

43. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à formater une image de fichier et un masque (FIM), dans lequel ledit processeur de rendu crée une commande d'en-tête pour ledit moteur graphique, qui est écrite dans ledit moteur graphique et indique un nombre de pixels à composer, une adresse de pixel de début et un mode de composition.

44. Procédé selon la revendication 41, dans lequel les données images de pixels RGBM sont transférées d'un emplacement de tampon (395) dudit moyen de mémorisation vers ledit processeur de rendu pour fournir des données d'images de pixels RGBM à l'entrée dudit moteur graphique.

45. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à écrire rapidement une image de fichier (FWI), dans lequel un nombre prédéterminé de lignes d'image de fichier compressée figurant dans ladite mémoire est développé en données d'images de pixels RGB par ledit compresseur-expanseur et écrit dans ladite mémoire de composition.

46. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à charger des tables de Huffman pour la compression (LHC), dans lequel les tables de Huffman (380) nécessaires à la compression de transformation en cosinus discret adaptative des données d'images de pixels sont stockées dans ledit moyen de mémorisation et chargées à partir dudit moyen de mémorisation dans ledit compresseur-expanseur avant l'exécution de la compression.

47. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à charger les tables de Huffman pour l'expansion (LHE) dans lequel les tables de Huffman (380) nécessaires à l'expansion de transformation en cosinus discret adaptative des données d'images compressées sont stockées dans ledit moyen de mémorisation et transférées entre ledit moyen de mémorisation et ledit compresseur-expanseur avant l'exécution de l'expansion.

48. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à imprimer (PRN), dans lequel les données d'images de page compressées sont développées à partir dudit moyen de mémorisation par ledit compresseur-expanseur et écrites dans ladite mémoire de composition sous forme de données d'images de pixels, lesdites données d'images de pixels étant mises en tampon entre ladite mémoire de composition et une imprimante (154) pour ladite image de page.

49. Procédé selon la revendication 48, dans lequel lesdites données d'images de pixels RGB sont converties en données d'images magenta, cyan, jaune et noir pour envoi à ladite imprimante.

50. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à effectuer un zoom rapide par logiciel (QSZ), dans lequel ledit moteur graphique lit un nombre prédéterminé de lignes de données d'images de pixels RGBM, via ledit processeur de rendu, dans un emplacement de tampon dudit moyen de mémorisation, ledit moteur graphique créant une version zoomée desdites données de pixels d'images

pour affichage sur l'écran de travail associé (140).

51. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à lire un fichier compressé se trouvant sur disque (RAD), dans lequel un fichier d'images compressé est stocké sur un disque dur (120) associé à un moyen de calcul (200), ledit fichier d'images compressé étant lu sur ledit disque dur par ledit moyen de calcul et transféré dans un emplacement dudit moyen de mémorisation.

52. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à redimensionner un fichier d'images compressé (RAF), dans lequel ledit processeur de rendu lit un nombre prédéterminé de lignes de données de pixels RGBM à partir d'un emplacement de tampon (395) dudit moyen de mémorisation et crée une version redimensionnée desdites données en appliquant une conversion de taux d'échantillonnage bilinéaire, la version redimensionnée étant réécrite à l'emplacement du tampon.

53. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à réaliser une bande de masque d'objets (RBM), dans lequel une liste de rendu de commandes graphiques est fournie dans ledit moyen de mémorisation et lue par ledit processeur de rendu, ledit processeur de rendu fournissant une série de commandes de moteur graphique audit moteur graphique pour le rendu des données de pixels de masque.

54. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à rendre une bande d'objets (RBO), dans lequel une liste de rendu (397) résidant dans ledit moyen de mémorisation est interprétée par ledit processeur de rendu pour fournir des commandes de moteur graphique audit moteur graphique pour le rendu d'une bande d'objets.

55. Procédé selon la revendication 54, caractérisé en ce que les descriptions de polices (399) exigées pour le texte sont disponibles dans ledit moyen de mémorisation et également introduites dans ledit processeur de rendu.

56. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à lire une liste d'affichage sur disque (RDD), dans lequel le moyen de calcul associé (200) inclut un moyen de mémorisation à disque (120)et ladite liste d'affichage (220) est lue dans ledit moyen de mémorisation à disque et transférée dans ledit moyen de calcul pour transfert audit processeur de rendu.

57. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à recevoir une liste d'affichage provenant d'un réseau (RDE), dans lequel un moyen de calcul associé (200) est connecté à un réseau de communication (105) dans lequel une liste d'affichage (22) est lue dans ledit réseau de communication et transférée dans ledit moyen de calcul pour transfert audit processeur de rendu.

58. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à rendre un masque avec une image de fichier (RMF), dans lequel ledit processeur de rendu convertit une liste de rendu (397), résidant dans ledit moyen de mémorisation, en commandes de moteur graphique qui sont introduites dans ledit moteur graphique, ledit moteur graphique recevant des données d'images de pixels RGB provenant d'un emplacement de tampon (395) dudit moyen de mémorisation via ledit processeur de rendu, ledit moteur graphique délivrant des données de pixels RGBM.

59. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à effectuer un balayage (SCN), dans lequel un scanner d'images (152) fournit les données d'image de pixels RGB d'une image de page scannérisée qui est mise en tampon dans ladite mémoire de composition, lesdites données d'image de pixels étant mises en tampon entre ladite mémoire de composition et ledit compresseur-expanseur et compressées pour stockage dans ledit moyen de mémorisation sous la forme d'une image de page compressée.

60. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à balayer vers un écran de travail (STW), dans lequel un scanner d'images (152) fournit les données d'image de pixels RGB d'une image de page scannerisée qui sont introduites dans ladite mémoire de composition, lesdites données d'image de pixels étant mises en tampon entre ladite mémoire de composition et une mémoire d'affichage (370) associée à un écran de travail (140) pour l'affichage des données d'image de pixels.

61. Procédé selon la revendication 60, dans lequel un contrôleur de panoramique/zoom (350) connecté entre ladite mémoire de composition et ladite mémoire d'affichage permet d'agrandir l'image à afficher sur l'écran de travail.

62. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à écrire sur disque (WAD) une image compressée, dans lequel les données d'image compressées sont lues dans ledit moyen de mémorisation et transférées dans un moyen de calcul associé (200) et stockées dans un moyen de mémorisation à disque (120) connecté audit moyen de calcul.

63. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à écrire une liste d'affichage sur disque (WDD), dans lequel un moyen de calcul associé (200) crée une série de listes d'affichage (220) et dans lequel lesdites listes d'affichage sont transférées entre ledit moyen de calcul et un moyen de mémorisation à disque (120) qui y est connecté, en vue du stockage..

64. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à rendre directement les objets (XRO), dans lequel un moyen de calcul associé (200) crée directement des commandes de moteur graphique qui sont transférées entre ledit moyen de calcul, via ledit processeur de rendu, et ledit moteur graphique pour le rendu des objets.

65. Procédé selon la revendication 7, dans lequel ledit procédé inclut l'étape de traitement d'image consistant à zoomer vers un écran de travail (ZTW), dans lequel les données d'images de pages compressées sont développées à partir dudit moyen de mémorisation par ledit compresseur-expanseur et écrites sous forme de données d'image de pixels dans ladite mémoire de composition, ladite image de pixel étant transférée dans ledit moteur graphique en vue d'écrire lesdites données dans un contrôleur de panoramique/zoom (350), ledit contrôleur de panoramique/zoom agrandissant lesdites données avant de transférer lesdites données à une mémoire d'affichage (370) associée à un écran de travail (140).

66. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer des couches d'objets avec une image compressée, ledit processus de création d'images comprenant les étapes de traitement séquentiel consistant en ce qui suit :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu (CRL) à partir de ladite liste d'affichage ;

répétition des étapes suivantes pour chaque bande de l'image :

(iii) rendu simultané d'une bande d'objets, et chargement de tables de Huffman pour l'expansion (LHE) ;
(iv) rendu simultané d'une bande d'objets (RBO) et expansion d'une image de page (EPI) à partir dudit moyen de mémorisation ;
(v) rendu d'une bande d'un premier objet, chargement de tables de Huffman pour la compression (LHC), et composition d'une image à base d'objets (COI) ;
(vi) pour chaque nouvel objet de l'image à créer, rendu d'une bande du nouvel objet et composition de l'image à base d'objets ; et
(vii) compression d'une bande d'image de page (CPI).

67. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer un fichier au moyen d'un masque d'image, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu (CRL) à partir de ladite liste d'affichage ; répétition des étapes suivantes pour chaque bande de l'image :
(iii) chargement de tables de Huffman pour l'expanpansion(LHE) ;
(iv) expansion d'une bande d'image de page (EPI);
(v) expansion d'une bande d'image de fichier (EFI) ;
(vi) expansion d'une bande de masque de fichier EPM);
(vii) mise en tampon de la bande d'image de fichier et du masque (BIM) ;
(viii) formatage d'une bande de l'image de fichier et du masque (FIM) ;
(ix) chargement simultané des tables de Huffman pour la compression (LHC) et composition de la bande de l'image de fichier au moyen du masque de fichier (CFF) ; et
(x) compression d'une bande de l'image de fichier (CFF).

68. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer un fichier au moyen d'un masque de page, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu (CRL) à partir de ladite liste d'affichage ;

répétition des étapes suivantes pour chaque bande de l'image :

(iii) chargement de tables de Huffman pour l'expansion (LHE);
(iv) expansion d'une bande d'image de page (EPI);
(v) expansion d'une bande d'un masque de page (EPM);
(vi) expansion d'une bande d'une image de fichier (EFI);
(vii) mise en tampon de la bande de l'image de fichier (BFI) ;
(viii) formatage d'une bande de l'image de fichier (FFI);
(ix) chargement simultané de tables de Huffman pour la compression (LHC) et composition de la bande de l'image de fichier au moyen du masque de page (CFP) ; et
(x) compression d'une bande de l'image de page (CPI).

69. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer un fichier au moyen à la fois des masques de page et de fichier, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu (CRL) à partir de ladite liste d'affichage ;

répétition des étapes suivantes pour chaque bande de l'image :

(iii) chargement des tables de Huffman pour l'expansion (LHE) ;
(iv) expansion d'une bande d'une image de page (EPI) ; (v) expansion d'une bande d'un masque de fichier (EPM) ;
(vi) expansion d'une bande d'une image de fichier (EFI) ;
(vii) expansion d'une bande d'un masque de fichier (EFM) ;
(viii) mise en tampon d'une bande de l'image de fichier et du masque de fichier (BIM) ;
(ix) formatage d'une bande de l'image de fichier et du masque (FIM) ;
(x) chargement simultané de tables de Huffman pour la compression (LHC) et composition au moyen du fichier et du masque d'image (CBM) ; et
(xi) compression d'une bande de l'image de page (CPI).

70. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer des graphiques d'objets et du texte seulement, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;
(iii) chargement de tables de Huffman pour la compression (LHC) ;

répétition des étapes (iv) à (vii) pour chaque bande de l'image:

(iv) rendu d'une bande d'objets (RBO) et effacement de la mémoire de composition (CCB) ;
(v) rendu simultané d'une bande d'un premier objet (RBO) et composition de cette bande de l'image de page (COI) ;
(vi) répétition de l'étape (v) pour chaque nouvel objet de l'image de page ;
(vii) compression de la bande de l'image de page (CPI) ;

et à l'achèvement de l'étape (vii) pour la dernière bande :

(viii) chargement de tables de Huffman pour l'expansion (LHE); et

(ix) impression de la totalité de l'image (PRN).

71. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer une image de page existante, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) chargement de tables de Huffman pour l'expansion (LHE) ; et
(ii) impression de l'image de page (PRN).

72. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer une image compressée avec masque et graphiques, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL)
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;

répétition des étapes (iii) à (xi) pour chaque bande de l'image:

(iii) rendu simultané d'une bande d'objets (RBO), effacement de la mémoire de composition (CCB),et chargement de tables de Huffman pour l'expansion (LHE) ;
(iv) rendu simultané d'une bande d'objets (RBO) et expansion d'une bande d'image de fichier (EFI);
(v) rendu simultané d'une bande d'objets (RBO), et expansion d'une bande de masque de fichier (EFM);
(vi) rendu simultané d'une bande d'objets (RBO) et mise en tampon de l'image de fichier et du masque (BIM);
(vii) rendu simultané d'une bande d'objets (RBO) et formatage de l'image de fichier et du masque (FIM) ;
(viii) rendu simultané d'une bande d'objets (RBO), chargement de tables de Huffman pour la compression (LHC) et composition de la bande de fichier en utilisant le masque de fichier (CFF);
(ix) composition de la bande de l'image à base d'objets (COI) ;
(x) compression de la bande de l'image de page (CPI) ; et

à l'achèvement de l'étape (xii) pour la dernière bande :

(xi) chargement de tables de Huffman pour l'expansion (LHE); et
(xii) impression de l'image de page (PRN).

73. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer deux images avec masques d'objets et texte, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;

répétition des étapes (iii) à (xiii) pour chaque bande de l'image :

(iii) rendu simultané d'une bande de masque d'objets (RBM), effacement de la mémoire de composition (CCB), et chargement de tables de Huffman pour l'expansion (LHE) ;
(iv) rendu simultané d'une bande de masque d'objets (RBM), et expansion d'une bande d'une première image de fichier ;
(v) rendu simultané d'une bande de masque d'objets, et mise en tampon de la bande de la première image de fichier (EFI) ;
(vi) rendu d'une bande de masque à base d'objets avec la bande d'une première image de fichier (RMF) ;
(vii) rendu simultané d'une bande de masque à base d'objets (RBM), et composition de la bande de la première image de fichier avec le masque à base d'objets (CFO) ;
(viii) rendu simultané d'une bande de masque à base d'objets (RBM) et expansion d'une bande de la seconde image de fichier (EFI) ;
(ix) rendu simultané d'une bande de masque d'objets (RBM), et mise en tampon de la bande de la seconde image de fichier (BFI) ;
(x) rendu d'une bande de masque à base d'objets pour la seconde image de fichier (RMF) ;
(xi) rendu simultané d'une bande d'objets (RBO), chargement de tables de Huffman pour la compression

(LHC), et composition de la bande de la seconde image de fichier avec son masque (CFO);
(xii) composition d'une bande d'image de texte à base d'objets (COI);
(xiii) compression de la bande de l'image de page (CPI);

et à l'achèvement de l'étape (xiii) pour la dernière bande :

(xiv) chargement de tables de Huffman pour l'expansion (LHE) ; et
(xv) impression de l'image de page (PRN).

74. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer deux images avec masques de fichier et texte, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) rendu simultané d'une bande d'objets (RBO), chargement de tables de Huffman pour l'expansion (LHE) et effacement de la mémoire de composition (CCB) ;
(ii) création d'une liste d'affichage (CDL) ;
(iii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;

répétition des étapes (iv) à (xvi) pour chaque bande de l'image;

(iv) rendu simultané d'une bande d'objets (RBO), effacement de la mémoire de composition (CCB) et chargement de tables de Huffman pour l'expansion (LHE) ;
(v) rendu simultané d'une bande d'objets (RBO) et expansion d'une bande d'une première image de fichier (EFI) ;
(vi) rendu simultané d'une bande d'objets (RBO), et expansion d'une bande d'un premier masque de fichier (EFM);
(vii) rendu simultané d'une bande d'objets (RBO) et mise en tampon de la bande de la première image de fichier et du premier masque de fichier (BIM);
(viii) rendu simultané d'une bande d'objets (RBO) et formatage de la bande d'une image de fichier et du masque (FIM) ;
(ix) rendu simultané d'une bande d'objets (RBO), et composition de la bande de la première image de fichier en utilisant le premier masque de fichier (CIM) ;
(x) rendu simultané d'une bande d'objets (RBO) et expansion d'une bande d'une seconde image de fichier (EFI) ;
(xi) rendu simultané d'une bande d'objets (RBO) et composition de la bande de la première image de fichier en utilisant le premier masque de fichier (CFM) ;
(x) rendu simultané d'une bande d'objets (RBO) et expansion d'une bande d'une seconde image de fichier (EFI) ;
(xi) rendu simultané d'une bande d'objets (RBO) et expansion d'une bande d'un second masque de fichier (EFM);
(xii) rendu simultané d'une bande d'objets (RBO), et mise en tampon de la bande de la seconde image de fichier et de la bande du second masque de fichier (BIM);
(xiii) rendu simultané d'une bande d'objets (RBO) et formatage de la seconde image de fichier et du masque (FIM) ;
(xiv) rendu simultané d'une bande d'objets (RBO), chargement de tables de Huffman pour la compression (LHC) et composition de la bande de la seconde image de fichier et de son masque (CFM) ;
(xv) composition d'une bande de texte d'image à base d'objets (COI) ;
(xvi) compression de la bande de l'image de page (CPI) ; et

à l'achèvement de l'étape (xvi) pour la dernière bande :

(xvii) chargement de tables de Huffman pour l'expansion (LHE); et
(xviii)impression de l'image de page (PRN).

75. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à imprimer trois images rectangulaires opaques avec texte, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;

répétition des étapes (iii) à (viii) pour chaque bande de l'image :

(iii) rendu simultané d'une bande d'objets (RBO), effacement de la mémoire de composition (CCB), et chargement de tables de Huffman pour l'expansion (LHE) ;
(iv) rendu simultané d'une bande d'objets (RBO) et écriture rapide d'une bande d'une première image de fichier dans ladite mémoire de composition (FWI) ;
(v) rendu simultané d'une bande d'objets (RBO) et écriture rapide d'une bande d'une seconde image de fichier dans ladite mémoire de composition (FWI) ;
(vi) rendu simultané d'une bande d'objets (RBO), et écriture rapide d'une bande d'une troisième image de fichier dans ladite mémoire de composition(FWI) ;
(vii) chargement simultané de tables de Huffman pour la compression (LHC) et compression de la bande d'une image de page provenant de ladite mémoire de composition (COI) ; et
(viii) compression de la bande de l'image de page (CPI)

à l'achèvement de l'étape (viii) pour la dernière bande :

(ix) chargement de tables de Huffman pour l'expansion (LHE) ; et
(x) impression de l'image de page (PRN).

76. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à zoomer vers un écran de travail, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) chargement de tables de Huffman pour l'expansion (LHE) ; et
(ii) zoom vers un écran de travail (ZTW).

77. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer des graphiques sur un écran de travail, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL);

répétition des étapes suivantes pour chaque bande de l'image :

(iii) rendu d'une bande d'objets (RBO) ;
(iv) rendu simultané d'une bande d'un premier objet (RBO) et composition de ladite bande sur ledit écran de travail (CTW) ;
(v) répétition de l'étape (iv) pour chaque nouvel objet de l'image ;
(vi) composition de la bande sur l'écran de travail (CTW).

78. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer un fichier sur un écran de travail en utilisant un masque de fichier, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes:

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL);
(iii) chargement de tables de Huffman pour l'expansion (LHE);

répétition des étapes suivantes pour chaque bande de l'image :

(iv) expansion d'une bande de l'image de fichier (EFI) ;
(v) expansion d'une bande du masque de fichier (EFM);
(vi) mise en tampon de la bande de l'image de fichier et de la bande du masque de fichier (BIM) ;
(vii) exécution d'un zoom rapide par logiciel sur ladite bande mise en tampon (QSZ) ;

(viii)formatage de la bande de l'image de fichier et du masque (FIM) ; et
(ix) composition de la bande sur l'écran de travail (CTN).

79. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à écrire une image de fichier sur un écran de travail sans masque, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes ;

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir de ladite liste d'affichage (CRL) ;
(iii) chargement de tables de Huffman pour l'expansion (LHE) ;

répétition de l'étape suivante pour chaque bande de l'image :
(iv) zoom de la bande sur l'écran de travail (ZTW).

80. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à composer une image de fichier sur un écran de travail en utilisant un masque de fichier, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) création d'une liste d'affichage (CDL) ;
(ii) création d'une liste de rendu à partir d'une liste d'affichage (CRL) ;
(iii)chargement de tables de Huffman pour l'expansion (LHE);

répétition des étapes suivantes pour chaque bande de l'image :

(iv) expansion d'une bande de l'image de fichier(EFI);
(v) mise en tampon de la bande de l'image de fichier (BFI);
(vi) exécution d'un zoom rapide par logiciel sur la bande de l'image de fichier (QSZ);
(vii)rendu d'une bande de masque avec la bande d'image de fichier (RMF) ; et
(viii)composition de la bande sur l'écran de travail (CTW).

81. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à effectuer un balayage de test, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) chargement de tables de Huffman pour la compression (LHC) ;
(ii) balayage des données d'images sur l'écran de travail (STW).

82. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à balayer une image de page, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) chargement de tables de Huffman pour la compression (LHC) ;
(ii) balayage de l'image de page (SCN).

83. Procédé selon la revendication 7, dans lequel ledit procédé inclut le processus de création d'image consistant à balayer, détourer et classer une image de page, ledit processus de création d'image comprenant les étapes de traitement séquentiel suivantes :

(i) chargement de tables de Huffman pour la compression (LHC);
(ii) balayage de l'image de page (SCN) ;

répétition des étapes (iii) à (vi) pour chaque bande de l'image:

(iii)chargement de tables de Huffman pour l'expansion (LHE);
(iv) expansion d'une bande de l'image de fichier (EFI);
(v) chargement de tables de Huffman pour la compression (LHC);
(vi) compression de la bande de l'image de fichier (CFI);

à l'achèvement de l'étape (vi) pour la dernière bande :

(vii) écriture des données compressées dans un moyen de mémorisation rémanent (WAD).

84. Système de publication assistée par ordinateur destiné à être utilisé selon le procédé de création d'image revendiqué dans l'une quelconque des revendications précédentes, le système comprenant un moyen de mémorisation (340) conçu pour stocker des données d'images compressées sous forme d'une pluralité de bandes ; caractérisé par des moyens (310, 320, 330,340) servant à créer et éditer ladite image en procédant à des passes séquentielles multiples sur lesdites bandes, chacune desdites passes étant appliquée à l'une desdites bandes pour la compresser et la stocker.

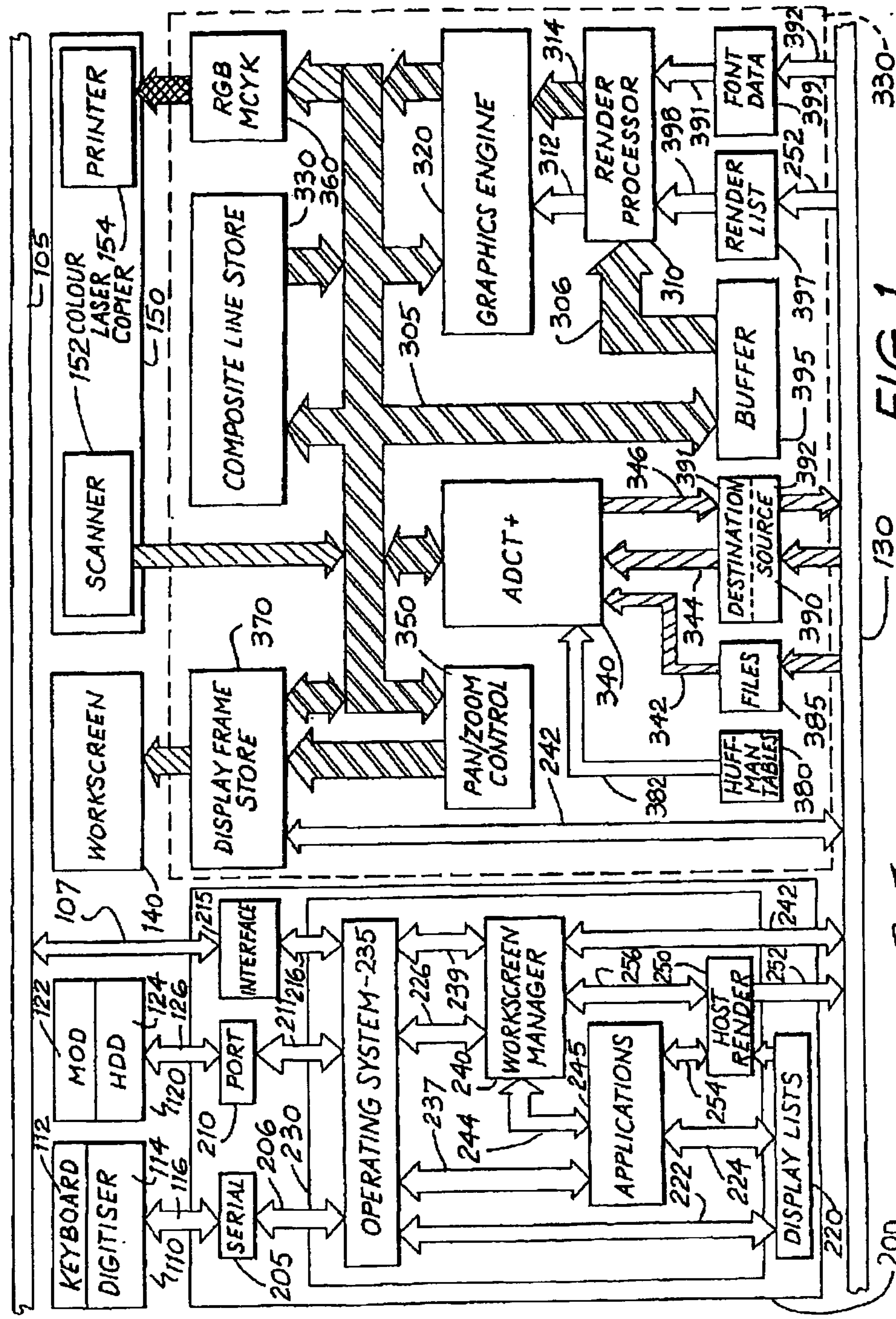

KEYBOARD
DIGITISER
MOD
HDD
SCANNER
PRINTER
COLOUR LASER COPIER
WORKSCREEN
DISPLAY FRAME STORE
COMPOSITE LINE STORE
RGB MCYK
PAN/ZOOM CONTROL
ADCT+
GRAPHICS ENGINE
RENDER PROCESSOR
HUFF-MAN TABLES
FILES
DESTINATION
SOURCE
BUFFER
RENDER LIST
FONT DATA
SERIAL
PORT
INTERFACE
OPERATING SYSTEM-235
WORKSCREEN MANAGER
APPLICATIONS
HOST RENDER
DISPLAY LISTS

FIG. 1

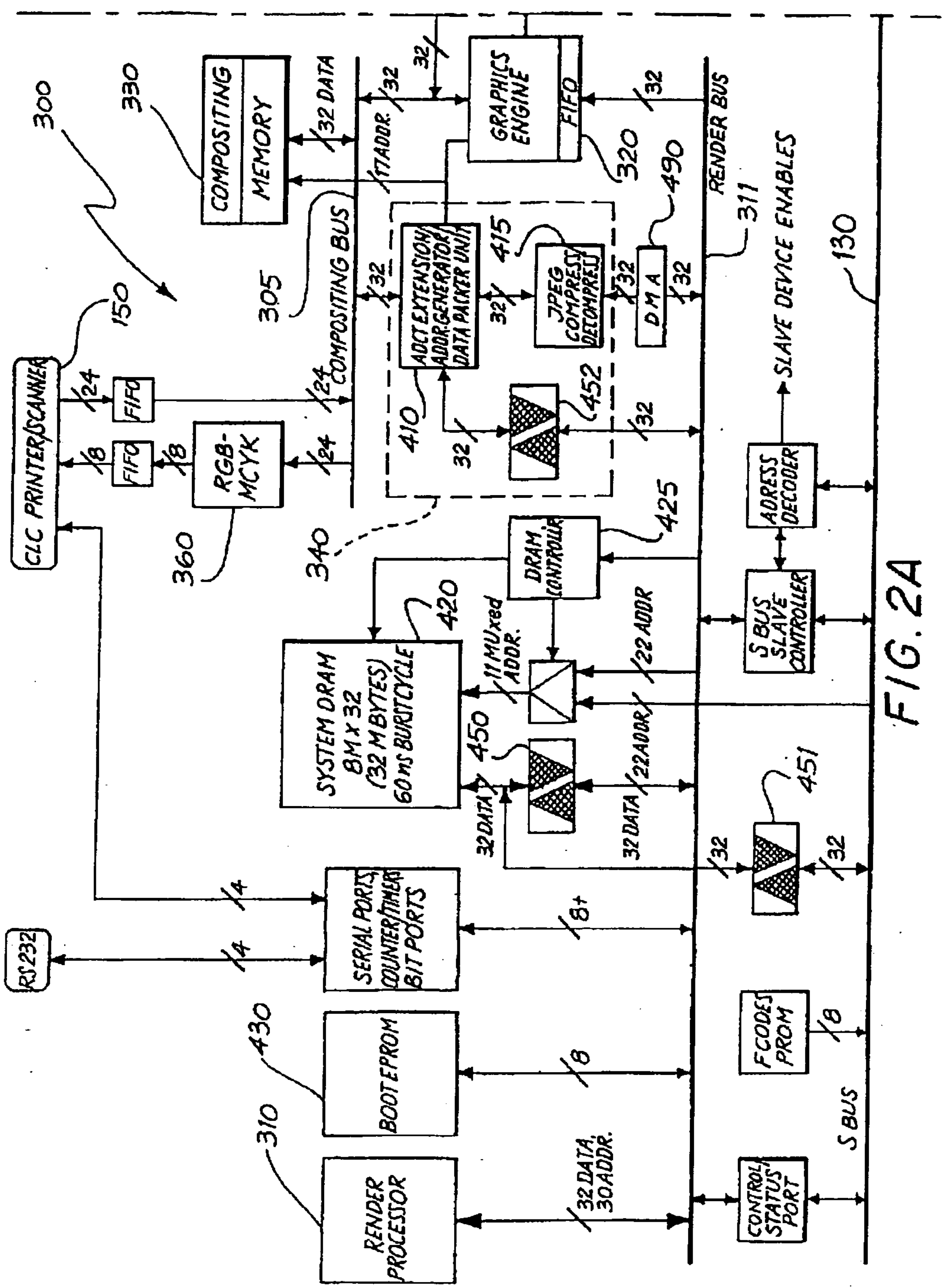

300
330
COMPOSITING
MEMORY
32 DATA
32
17 ADDR.
32
GRAPHICS ENGINE
FIFO
32
320
490
RENDER BUS
311
SLAVE DEVICE ENABLES
130
150
CLC PRINTER/SCANNER
24
FIFO
24
COMPOSITING BUS
305
32
ADCT EXTENSION/ ADDR.GENERATOR/ DATA PACKER UNIT
415
32
JPEG COMPRESS/ DECOMPRESS
32
DMA
32
410
452
32
32
8
FIFO
8
RGB-MCYK
24
360
340
ADRESS DECODER
DRAM CONTROLLER
425
S BUS SLAVE CONTROLLER
420
SYSTEM DRAM 8M x 32 (32 MBYTES) 60 ns BURST CYCLE
11 MUXed ADDR.
22 ADDR
22 ADDR
450
32 DATA
32 DATA
451
32
32
4
SERIAL PORTS, COUNTER/TIMER BIT PORTS
8+
RS232
4
430
BOOT EPROM
8
F CODES PROM
8
310
RENDER PROCESSOR
32 DATA, 30 ADDR.
CONTROL STATUS PORT
S BUS

FIG. 2A

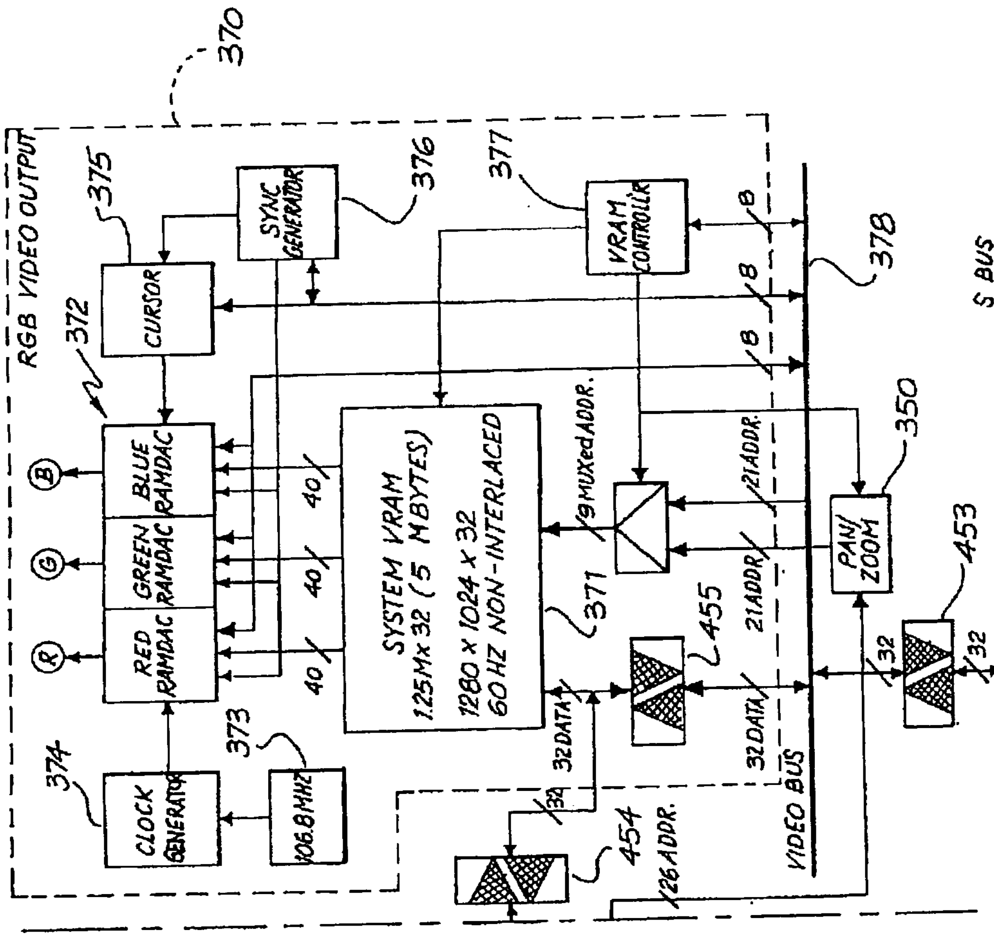

370
RGB VIDEO OUTPUT
375
376
377
372
CURSOR
SYNC GENERATOR
VRAM CONTROLLR
8
378
S BUS
BLUE RAMDAC
GREEN RAMDAC
RED RAMDAC
B
G
R
40
SYSTEM VRAM
1.25M x 32 (5 MBYTES)
1280 x 1024 x 32
60 HZ NON-INTERLACED
371
9 MUXed ADDR.
21 ADDR.
350
PAN/ZOOM
453
455
32
32 DATA
VIDEO BUS
374
373
CLOCK GENERATOR
106.8 MHZ
454
26 ADDR.

FIG. 2B

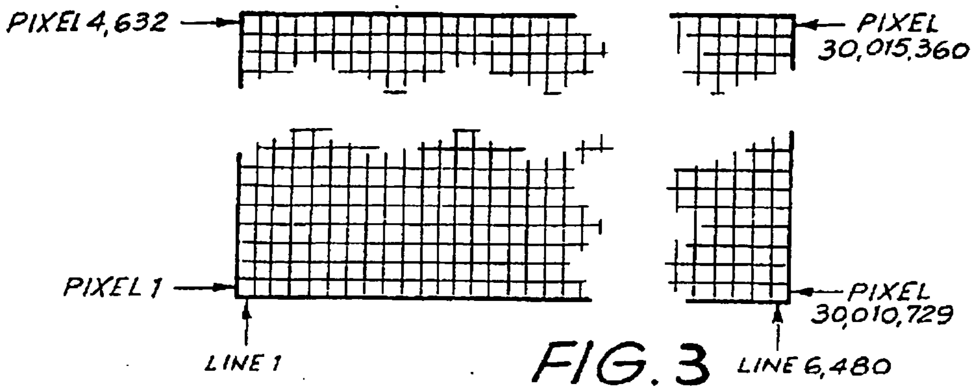


FIG. 3

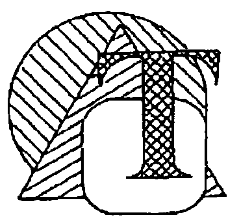


FIG. 4

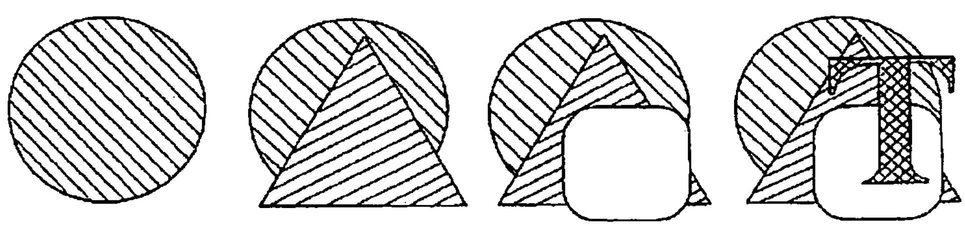
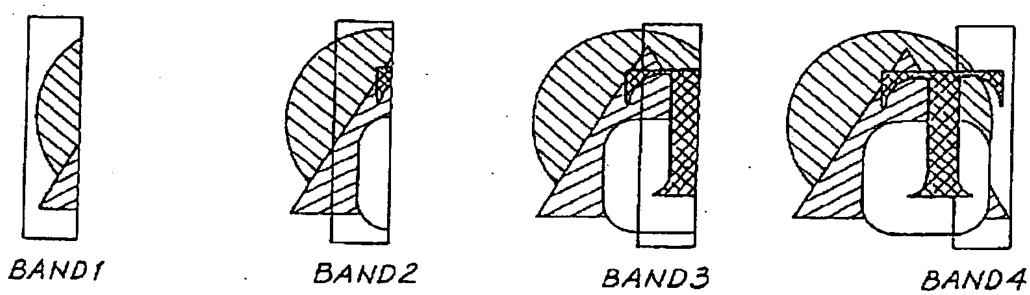


FIG. 5

FIG. 6



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